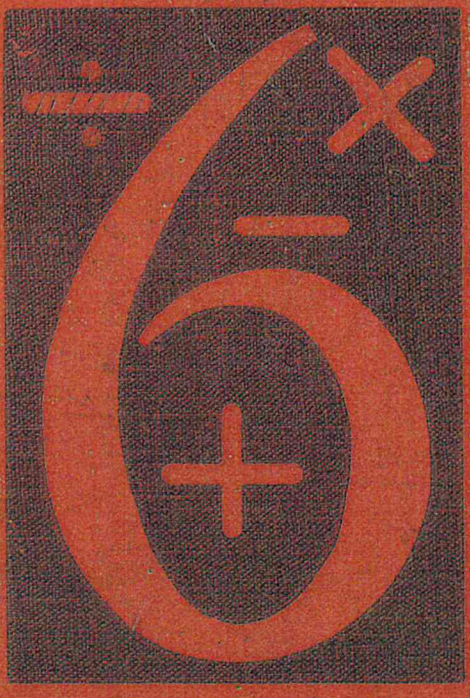

ARITHMETIC WE USE

GRADE 6

ARITHMETIC WE USE

BY

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GRADE VI

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INTRODUCTION

Basic Plan of the Series. The modern arithmetic program recognizes two major phases of the subject, namely, the mathematical phase and the social phase. The purpose of the mathematical phase is to teach the nature of the number system. The purpose of the social phase is to help the pupil to understand and to utilize effectively the quantitative procedures that he will need daily in the social order of which he is a part.

The basis of instruction throughout this series of textbooks is (1) the number system and (2) its social significance. Through carefully planned activities the pupil is taught to understand the nature of the number system. This understanding insures a meaningful grasp of the procedures that are presented in the various computational processes. At the same time the pupil is led to see the social significance of arithmetic through the study of rich informational units of work dealing with everyday applications of number processes and quantitative procedures. In addition, numerous activities are suggested which require pupils to investigate social applications of arithmetic in their own communities. This plan insures a well integrated treatment of both phases of the subject.

Scientific Gradation of Subject Matter. To insure successful growth in arithmetic power, the authors have carefully considered the findings of important investigations of grade placement of arithmetic topics, and have made extensive surveys of their own, to determine the most satisfactory points at which to present the various elements of the work. As a result, the work of each grade has been considerably simplified and the teaching load greatly reduced. The easier phases of a topic,—for example, division with two-figure divisors,—are presented at least one year previous to the introduction of phases known to be more difficult for children to learn. This scientific gradation of the subject matter insures easy learning and mastery of the various processes.

The major phases of the arithmetic processes taught in Grade 6 are as follows:

1. Multiplication by three or more figure multipliers.
2. Division by two-figure divisors when the estimated quotient must be corrected.
3. Addition and subtraction of unlike fractions.
4. Multiplication and division of fractions.
5. Multiplication and division of decimals—first steps only, with small numbers.

Basic Elements of a Readiness Program. Recent investigations by the authors and others have demonstrated conclusively that many pupils are not ready for the new work that is about to be presented. This may be due to the fact that they have had little, if any, previous contact with the topic to give it meaning, or it may be due to weaknesses in underlying skills that they have not yet mastered. Unless these deficiencies are discovered and

corrected before the new work is begun; it is practically certain that serious maladjustments will result.

The authors have taken two major steps to insure pupil readiness for the new work. The first step has been to make certain that the pupil has direct contact with important concepts, for example the meaning of fractions, long before he is required to compute with them. The authors believe that meaning gained through experience should always precede practice for mastery. The second step has been the provision of a complete series of experimentally-developed readiness tests which enable the teacher to locate the pupils likely to have difficulty with the new work and to locate the points that are likely to lead to the difficulty. On the basis of the information revealed by these readiness tests, the teacher can either do any reteaching that may be required, or adjust the subsequent instruction in the new step to the needs of each individual.

Teaching Procedures that Insure Mastery of Arithmetic. These textbooks present an instructional program that has been thoroughly tested in hundreds of schools. They provide a systematic step-by-step development of the fundamental operations in such a way that each step is both mathematically meaningful and socially significant. Illustrations, pictures, diagrams, and other kinds of visual aids are extensively used to help the pupils to get an insight into the mathematical meaning of the step being presented. Following this concrete development of a step, there are worked-out models for study and solution before practice on the new step is begun. The explanations of procedure are specific and detailed so that the difficulties learners sometimes encounter in the study of arithmetic are reduced to a minimum. Diagnostic tests keyed to study helps and remedial practice are provided at frequent intervals to assist the teacher in locating pupils' needs for additional instruction. These tests make it possible for the teacher to provide effectively for individual differences. They also insure intelligent cooperation by the learner toward the correction of any difficulties he may encounter. The skills that have been taught are frequently reintroduced in the units of problem material to insure proper maintenance. Frequent mixed drills of a cumulative nature are also provided. The problems illustrating the applications of the processes are stated in simple language that children understand.

Analysis of the Features of the Series. To assist teachers and members of textbook committees in their use and evaluation of this textbook, the detailed analysis of features given below is provided. Similar analyses for the other books of the series are included in each textbook. In instances where the number of page references that might be given is very large, only typical pages are listed. The reader should consult the index for additional details.

1. Recognition of the social phase of arithmetic

a. Problem units dealing with social applications of arithmetic: 1, 4, 6, 8, 10, 11, 20, 27, 37, 46, 50, 52, 56, 60, 61, and many others

b. Correlations with other areas of the curriculum

(1) Health: 86, 87, 115, 135, 137, 141, 178, 208, 209, 210, 269

(2) Social studies: 1, 10, 20, 40, 66, 71, 78, 79, 149, 154, 168, and many others

(3) Science: 37, 50, 51, 56, 64, 93, 105, 138, 143, 146, 161, 181, 184, 194, 216, 247, 292, 302

(4) Arts and Music: 73, 110, 112, 173

(5) Safety: 240, 241, 242

c. Wide variety of illustrations, graphic and tabular material, pictures, and business forms: 1, 4, 6, 8, 11, 39, 78, 84, 126, 154, 163, 175, 208, 210, 240, 242, 251, 252. See also 2d.

d. Vocabulary development: 3, 34, 68, 99, 100, 132, 158, 195, 196, 230, 232, 265

2. Meaningful mathematical development of number processes

a. Consideration of the nature of the number system as such: 16, 31, 38, 44, 45, 95, 201, 236, 256, 279, 280, 283

b. Each new step presented in a social setting

(1) Multiplication with three- and four-figure multipliers: 55, 57, 58, 59, 174

(2) Division with two-figure divisors when estimated quotient must be corrected: 74, 76, 77, 80, 82, 88, 89, 95, 96

(3) Addition of unlike fractions: 106, 107, 109, 111, 113, 114, 116, 118, 121, 122, 124

(4) Subtraction of unlike fractions: 139, 140, 144, 145, 147, 148

(5) Multiplication of fractions: 164, 165, 166, 170, 177, 180, 182, 183, 185, 188

(6) Division of fractions: 202, 203, 204, 205, 206, 207, 211, 213, 218, 219, 220, 228, 229, 231

(7) Multiplication of decimals: 243, 244, 245, 246, 248, 253, 254, 256, 258

(8) Division of decimals: 273, 274, 275, 276, 277, 280, 287, 288, 289, 290, 291, 294, 295

c. Models for study and solution before formal practice: 41, 42, 48, 55, 57, 58, 59, 75, 76, 77, 80, 88, 109, and many others

d. Helps, including visualization, on difficult steps: 13, 15, 43, 51, 80, 82, 91, 95, 96, 107, 108, 116, 117, 120, 144, and many others

e. Relationships between processes stressed: 16, 31, 42, 43, 49, 123, 165, 239, 243, 244, 253, 258, 264, 273, 274, 279, 289

f. Practice on new steps: 55, 57, 58, 59, 74, 76, 77, 80, 82, 88, 89, 96, and many others

g. Periodic keyed diagnostic tests to locate specific weaknesses: 47, 53, 65, 130, 153, 172, 193, 215, 227, 250, 261, 283, 301

h. Mixed practice to insure retention of skills presented: 34, 43, 46, 49, 51, 52, 54, 59, 63, 68, 75, 81, 82, 85, and many others

i. Cumulative review tests keyed to practice exercises: 36, 70, 102, 119, 134, 160, 198, 234, 268, 306

3. Development of power to apply quantitative procedures

a. Utilization of problem materials within experiences of most children: See 1a for page references

b. Special helps on problem solving, including reading exercises: 11, 16, 18, 21, 24, 30, 31, 32, 33, 40, 61, 63, 90, 98, 108, 125, 171, 201, 205

c. Original problems to be prepared by pupils: 33, 53, 60, 65, 90, 95, 98, 120, 129, 153, 164, 193, 285, etc.

d. Activities requiring applications to new situations: 4, 6, 8, 20, 65, 84, 95, 110, 115, 137, 142, 163, and many others

e. Pictures and illustrations to be discussed: 4, 6, 39, 106, 108, 116, 120, 142, 164, 175, 192, 199, 205, and many others

f. Interpretation of graphs, tables, charts, maps, etc.: 78, 79, 84, 126, 152, 163, 175, 208, 209, 210, 225, 240, 242, 251, 252

4. Comprehensive testing program

a. Inventory tests: 2, 5, 22

b. Diagnostic review tests to locate specific needs, plus the practice: 5, 7, 9, 12, 14, 17, 19, 22, 23, 25, 26, 28, 29

c. Readiness tests on new work to be presented: 72, 104, 136, 162, 200, 239, 270

d. Keyed diagnostic tests geared into the new developmental work: 47, 53, 65, 97, 130, 153, 172, 193, 215, 227, 250, 261, 283, 301

e. Periodic cumulative diagnostic tests keyed to practice exercises: 36, 70, 102, 134, 160, 198, 234, 268, 306

f. Problem scales for measuring power in problem solving: 35, 69, 101, 133, 159, 197, 233, 267, 305

g. Chapter reviews: 67, 99, 131, 158, 196, 230, 266

5. Adaptation of instruction to individual differences

a. See the comprehensive testing program outlined under 4 for locating needs

b. Tests, study helps and practice exercises for individualizing review at the beginning of the year's work (See 4b)

c. Readiness program and tests to help the teacher to locate possible causes of difficulty (See 4c)

d. Starred problems and activities for enrichment and for the more able pupils: 4, 6, 11, 20, 40, 43, 56, 61, 62, 64, 71, 73, 79, 92, 112, and many others

e. Topics for special reports as a means of exploring and developing pupil interests: 37, 50, 67, 73, 103, 131, 138, 143, 155, 169, 173, 179, and many others

f. Special assignments for pupils not needing review or corrective exercises: 53, 65, 97, 130, 153, 172, 193, 215, 228, 250, 283, 301

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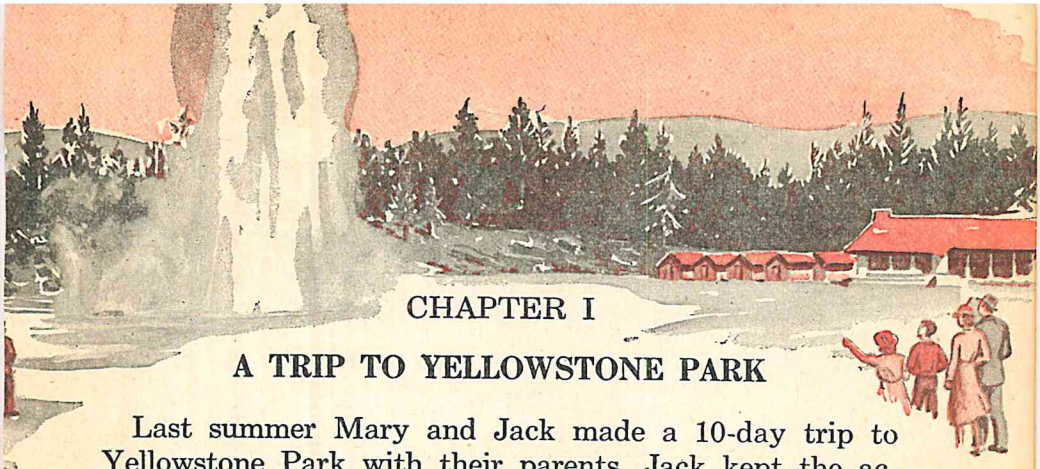


CHAPTER I

A TRIP TO YELLOWSTONE PARK

Last summer Mary and Jack made a 10-day trip to Yellowstone Park with their parents. Jack kept the account of the expenses for their car and Mary kept the account of the expenses for their food and lodging.

1. These are the totals for Jack's account: gasoline $20.37, oil and grease $2.50, garage $1.50, new tire and tube $23.48. Find the total of these amounts.

2. Mary's totals were as follows: meals $47.80, cabins $16.55, fruit and candy $1.40. Find the total amount spent for these things.

3. How much less were the expenses of the car than the cost of the food and lodging?

4. They rented a cabin in the park where they stayed four nights. The cabin cost $2.25 a night. How much did the cabin cost for the 4 nights? What was the average cost for each person?

5. If they had stayed at the hotel, the cost for each person for one night would have been $2.75. How much would the rooms for all for the four nights have cost?

6. According to Jack's record, they used 97 gallons of gasoline. What was the average cost of the gasoline a gallon? What is the price where you live?

*7. In all they drove the car 1,746 miles on the trip. How many miles did they go on a gallon? Is this a good mileage?

HOW WELL DO YOU REMEMBER?

How well do you remember the arithmetic you have learned? This test will help you to find out. It contains the important kinds of examples you have studied. Copy the examples carefully, leaving enough space for your work. How many of them can you work correctly?

1. $\frac{1}{4} + \frac{1}{4} =$

2. $9023 - 8505$

3. 7090×6

4. $33\overline{)396}$

5. $6\frac{3}{4} - 2\frac{1}{4}$

6. $40\overline{)1623}$

7. $6\frac{1}{2} + 5\frac{1}{2}$

8. 247×85

9. $8 - 2\frac{1}{4}$

10. $5\frac{3}{4} + 6\frac{3}{4}$

11. $85\overline{)6290}$

12. $7\frac{1}{3} - 4\frac{2}{3}$

13. Find the sum of \$87.65, \$9.89, \$76.08, and \$97.67.
14. Divide \$612.56 by 76 and check your work.
15. Multiply \$95.60 by 49.
16. Subtract 97.6 from 108.3.

What Your Scores Mean (Number correct)

Unsatisfactory	Fair	Good	Excellent
0 to 10	11 12	13 14	15 16

1. If a pupil has 11 correct, his rating is "Fair." What is your rating on the test?
2. How many in the class received each rating?
3. What examples did you work incorrectly? What errors did you make?
4. Are there any examples that you did not know how to work?
5. Did you check your work in these examples?
6. What practice do you need?

FOR THOSE WHO NEED MORE PRACTICE

You will find that if you practice a little each day, your work will improve very quickly. On the pages given below there are practice exercises in the different processes with whole numbers.

Addition, page 7
Subtraction, page 9
Multiplication, page 12
Division—One-figure divisor, page 12
Two-figure divisor, pages 15, 17, and 19

If you make errors in the addition test on page 5, turn to page 7 for practice exercises. Follow carefully the directions that are given. When you have completed the practice in addition, repeat the test on page 5 to see how much your work has improved. Then practice the next process in which you made errors in the tests on page 5. Even if you made no errors in the tests, a little practice on the processes is worth while. If you do not need to practice on whole numbers, turn at once to the diagnostic tests on fractions on page 22.

NAMES OF PARTS OF EXAMPLES

			40 r21
27	5986	286	24)981
43	−1572	×5	96
51	4414	1430	21
121			

The words below are the names of parts of examples. Find a number above for each name given below.

1. multiplier
2. sum
3. remainder
4. partial product
5. dividend
6. product
7. quotient
8. divisor
9. difference
10. Tell how to check each of the above examples.

THE MONTGOMERY LAWN MOWING COMPANY

(A True Story)

Last summer William Montgomery mowed Mr. Hance's lawn while the Hance family was on a vacation. Here is the account of his time and expenses that William gave Mr. Hance when he returned.

The Montgomery Lawn Mowing Company
Jenkintown, Pennsylvania
William Montgomery, Owner

To L. S. Hance — Aug. 14, 19—

July 30	Repairs to mower	$1.50	
Aug. 14	Mowing lawn - 23 hours	5.75	
			$7.25

1. How much did William charge an hour for mowing the lawn?

2. William mowed the lawn 5 times. How much did he receive for each mowing?

3. How long did it take him on the average to mow the lawn?

4. He had to have the lawn mower repaired. The new parts needed cost $.40. How much did the repair man charge for his labor?

5. William paid for the repairs when they were made. How much should Mr. Hance pay William in all?

*6. How do boys and girls where you live earn money?

*7. What is a "charge account" at a store?

*8. What is a "receipt"?

DIAGNOSTIC TESTS IN WHOLE NUMBERS

These tests will help you to find the processes in whole numbers that you need to practice. If you make more than one mistake on a test, and if you cannot do the exercises in the time given, you need more practice in the process.

Addition Test

	a	*b*	*c*	*d*	*e*	*f*
1.	486	903	720	9765	5668	986
	593	904	430	8973	865	6474
	974	609	270		27	69
2.	787	1835	500	$10.96	$45.33	$.15
	364	9772	25	36.40	.66	.16
	592	245	7849	50.52	60.94	27.22
	749	9684	5988	32.23	33.15	9.93

Subtraction Test

	a	*b*	*c*	*d*	*e*	*f*
1.	397	17764	8000	17010	9602	7004
	298	9281	3108	9040	3908	3008
2.	$79.93	$38.65	$74.47	$82.04	$90.00	$112.40
	19.75	38.58	69.47	81.93	.75	3.87

Multiplication Test

	a	*b*	*c*	*d*	*e*	*f*
1.	24	867	$9.04	$8.90	$37.04	$28.00
	×5	×9	×8	×6	×2	×3
2.	96	87	$5.78	$9.05	$7.50	$8.09
	×57	×70	×85	×93	×64	×40

Division Test

	a	*b*	*c*	*d*	*e*	*f*
1.	$7\overline{)987}$	$6\overline{)425}$	$4\overline{)1860}$	$5\overline{)\$17.95}$	$8\overline{)\$16.48}$	$9\overline{)\$81.05}$
2.	$21\overline{)1491}$	$54\overline{)2214}$	$42\overline{)1008}$	$63\overline{)3780}$	$76\overline{)3952}$	$95\overline{)29165}$

DOG LAUNDRY
WE BATHE DOGS

LARGE DOGS 25¢
SMALL DOGS 15¢

A DOG LAUNDRY

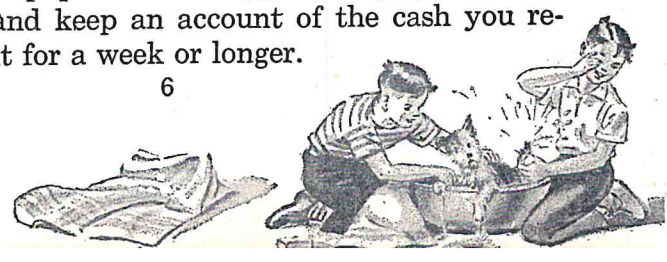
"Let's start a dog laundry and wash dogs for money," said George. So he and his brother made the signs which you see at the top of the page. Below is given a page from their cashbook showing the cash they received and the cash they paid out the first week.

Cash Received			Cash Paid Out		
Aug. 8	2 small dogs	$.30	Aug. 8	2 bars flea soap	$.50
Aug. 9	1 large, 1 small	.40	Aug. 8	1 brush	.40
Aug. 10	2 large, 2 small	.80	Aug. 9	1 cashbook	.15
Aug. 12	1 large, 4 small	.85	Aug. 12	1 bar flea soap	.25
Aug. 13	2 large, 3 small	.95			
	Total	?		Total	?

1. How much cash was received in all during the week?
2. Check each day's total cash received to see if the amounts given are correct.
3. How much cash did the boys pay out during the week?
4. How much did the boys have left at the end of the week after paying their expenses? We call this amount their **profits.**
5. If they divided their profits equally, how much did each boy receive?

*6. Why is it necessary for business men to keep accounts of the cash received and of the cash paid out?

*7. On a sheet of paper draw a copy of the page from the boys' cashbook and keep an account of the cash you receive and pay out for a week or longer.



GRADED PRACTICE IN ADDITION

Practice one set of examples a day. Keep a record of your scores to see how your work improves. Write the sums on folded paper placed below the examples.

Set I

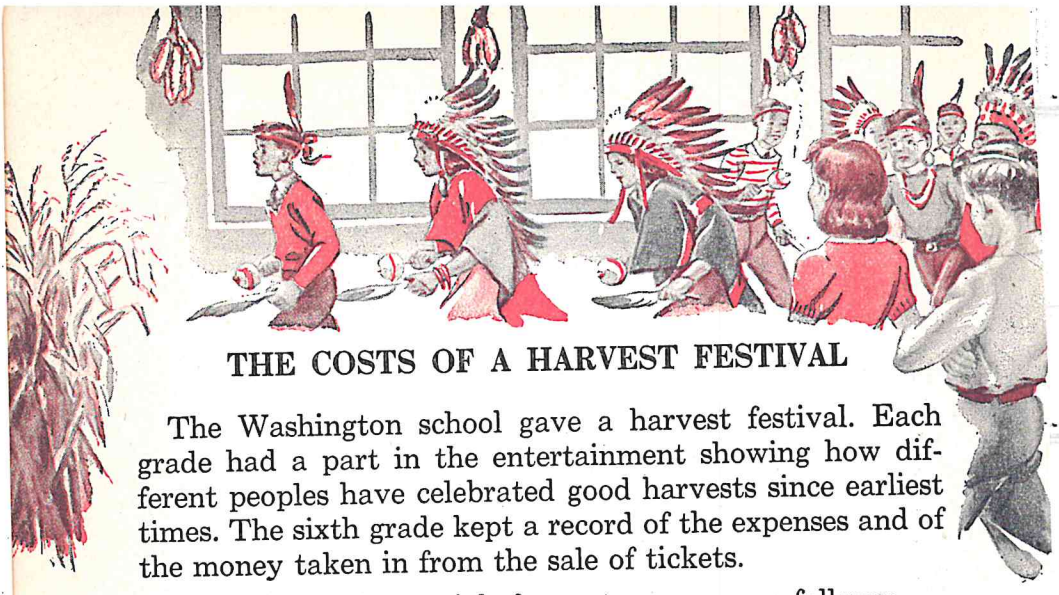
	a	*b*	*c*	*d*	*e*	*f*
1.	413	422	103	170	121	$2.00
	214	153	305	500	434	1.09
	302	214	300	206	124	3.80
2.	678	597	983	698	875	$6.45
	559	485	479	487	746	3.07
	628	786	922	565	675	7.08

Set II

1.	9997	638	10	768	3543	$68.10
	268	4866	9755	279	7366	8.92
	16	27	588	3895	796	27.99
2.	7437	8788	5766	3438	4373	$62.89
	2768	8985	1944	4094	6855	99.89
	9894	6693	8475	2905	6450	98.78
	6954	5947	7768	6007	3644	69.79

Set III

372	252	375	875	$7.27	$8.59
389	926	797	964	4.26	2.46
512	845	130	463	8.48	3.75
795	596	211	908	5.93	9.18
169	663	440	271	3.86	1.57
931	378	388	447	8.77	6.48



THE COSTS OF A HARVEST FESTIVAL

The Washington school gave a harvest festival. Each grade had a part in the entertainment showing how different peoples have celebrated good harvests since earliest times. The sixth grade kept a record of the expenses and of the money taken in from the sale of tickets.

1. The cost of materials for costumes was as follows:

25 yd. yellow cambric at 20¢ — 8 yd. muslin at 25¢
8 yd. brown cambric at 18¢ — 16 yd. ribbon at 15¢

Find the cost of each item and the total cost of the materials for costumes.

2. Other expenses of the festival were as follows:

1 telegram $.56 — Postage and insurance $.74
1 telephone call $.35 — Advertising $4.50
8 copies of "The Harvest Day" at 40¢ a copy — 4 pumpkins at 25¢
8 lanterns at 10¢

Find the total of these expenses.

3. How much was the total for costumes and expenses?

4. They sold 248 tickets at 25 cents each and 140 tickets at 10 cents each. How much was received from the sale of tickets?

5. How much more was received for the tickets than the total expenses?

*6. Suggest ways in which this money might be used if your school had given this festival.

PRACTICING SUBTRACTION USED IN DIVISION

Set I

	a	*b*	*c*	*d*	*e*	*f*
1.	385	497	675	564	371	432
	−364	−480	−665	−504	−336	−408
2.	580	550	601	400	976	708
	−528	−514	−552	−396	−891	−696

Set II

	a	*b*	*c*	*d*	*e*	*f*
1.	404	758	553	305	732	520
	−384	−688	−490	−270	−686	−485
2.	513	310	568	600	512	410
	−465	−264	−568	−600	−500	−405

Set III

	a	*b*	*c*	*d*	*e*	*f*
1.	8524	8735	4445	8023	4832	$489.20
	2589	3691	3466	3874	1648	50.90
2.	7003	18040	7500	27090	9301	$462.85
	3057	14809	4796	12084	4029	427.59

Set IV

	a	*b*	*c*	*d*	*e*	*f*
1.	9360	10701	5336	2761	5180	$340.75
	6952	3904	3984	1776	2581	124.57
2.	6282	16481	14834	14334	9476	$963.12
	3396	8972	6928	7456	7587	647.89

"WINGS"

1. Before Gene Eaton received his "wings" as a transport pilot, he had flown 2000 hours in the air. How many 8-hour flying days was this?

2. A transport pilot is not allowed to fly more than 8 hours at one time. Then he must take "time off" for at least one full day and night. If Gene's ship flies 240 miles in an hour, how far does it fly in 7 hours?

3. Pilots can fly 85 hours a month. In a recent year they were paid $4.60 an hour for day flying. How much did a pilot receive for flying 7 hours?

4. Pilots fly on the average on 12 days a month. If they fly 7 hours on each of these days, how much do they receive for the flying?

5. For night flying, pilots were paid $6.90 an hour. How much more did a pilot receive for 7 hours of night flying than for 7 hours of day flying?

6. How much would a pilot receive for flying in a month in which he flew 50 hours by day and 35 hours by night?

7. In addition to the amount received for flying time the pilot was also paid $250 a month as "base pay." How much did the pilot in problem 6 receive for the month? How much would he receive for 12 months?

*8. What is done by the United States Government to make airplane flying safer?

*9. What kinds of things are shipped by air? Why are they shipped by air?

BUYING AT A SALE

Tom's father owns a clothing store. He is going to have a sale. Tom made the sign shown at the right telling about the reduced prices.

1. **Reduction** here means the prices asked at the sale are less than the regular prices. According to the sign, how much less are the prices?

2. Tom made out the price tags on some of the articles showing the regular and sale prices. What will be the reduction on a $20 suit of clothes?

THINK: Reduction = $\frac{1}{4}$ of regular price.
Reduction = $\frac{1}{4}$ of $20, or $5.

3. What will be the sale price of the $20 suit?

THINK: Regular price − reduction = sale price.
$20 − $5 = $15, the sale price.

4. What will be the reduction on a $6 hat?

5. Find the sale price of a pair of $5 shoes.

Find the reductions and sale prices of the following:

Article	Part Off	Regular Price	Reduction	Sale Price
6. Hat	$\frac{1}{4}$	$8.00	?	?
7. Overcoat	$\frac{1}{4}$	$22.00	?	?
8. Cap	$\frac{1}{3}$	$1.50	?	?
9. Coat	$\frac{1}{2}$	$18.75	?	?
10. Dress	$\frac{1}{4}$	$6.80	?	?

*11. Why do stores often sell goods at a reduction?

GRADED PRACTICE IN MULTIPLICATION

Practice one set of examples a day. Keep a record of your scores to see how your work improves.

Set I

	a	*b*	*c*	*d*	*e*	*f*
1.	213 × 3	413 × 2	430 × 3	502 × 2	321 × 4	\$3.10 × 5
2.	604 × 5	912 × 8	715 × 6	705 × 4	708 × 5	\$7.14 × 7

Set II

1.	968 × 4	827 × 9	925 × 5	853 × 7	758 × 8	\$4.86 × 6
2.	5960 × 9	9032 × 6	3409 × 9	9062 × 7	6430 × 8	\$98.56 × 3

Set III

1.	308 × 10	560 × 80	248 × 40	240 × 10	708 × 60	\$6.89 × 20
2.	974 × 28	479 × 79	957 × 43	\$9.56 × 61	\$3.98 × 82	\$6.81 × 59

GRADED PRACTICE IN DIVISION

Check the answers to the first two examples in each row.

	a	*b*	*c*	*d*	*e*	*f*
1.	$4\overline{)480}$	$3\overline{)609}$	$5\overline{)510}$	$2\overline{)1846}$	$6\overline{)3600}$	$8\overline{)4872}$
2.	$5\overline{)75}$	$4\overline{)96}$	$7\overline{)881}$	$6\overline{)923}$	$3\overline{)896}$	$2\overline{)975}$
3.	$9\overline{)873}$	$8\overline{)5711}$	$7\overline{)4872}$	$6\overline{)4345}$	$5\overline{)4866}$	$9\overline{)7531}$
4.	$4\overline{)563}$	$8\overline{)403}$	$6\overline{)5449}$	$9\overline{)4594}$	$8\overline{)6435}$	$4\overline{)3203}$
5.	$4\overline{)\$.36}$	$7\overline{)\$3.08}$	$5\overline{)\$23.40}$	$4\overline{)\$30.24}$	$3\overline{)\$23.58}$	$6\overline{)\$48.18}$

PLACING THE FIRST QUOTIENT FIGURE

In our number system each figure in a number has its place value. Thus, in the number 295 the 2 is in hundreds' place, the 9 is in tens' place, and the 5 is in ones' place. In 295 there are 29 tens and 5 ones, or 295 ones.

1. Tell the place value of each figure in this number: 2,965,784.

2. How many tens are there in each of the following numbers? How many ones? *a*. 457 *b*. 826 *c*. 985 *d*. 1526 *e*. 1408 *f*. 7460 *g*. 1020 *h*. 1003.

3. How many hundreds are there in each of the numbers below? How many tens? How many ones?

a. 695 *b*. 1200 *c*. 4603 *d*. 2057

4. In the example at the right can the number of hundreds be divided by 5? How many hundreds are there? Can the number of tens be divided by 5? Will the first figure in the quotient be placed over the 3 or the 6? Why?

$5\overline{)360}$

5. How many thousands are there in the number 1536? How many hundreds? How many tens? How many ones?

6. In the example at the right can the number of thousands be divided by 48? Can the number of hundreds be divided by 48? Can the number of tens be divided by 48? Will the first figure in the quotient be placed above the 5 or the 3? Why?

$48\overline{)1536}$

7. Where will the first quotient figure be placed in each of the following examples? Show how you can tell in each example. Then work the example to see if you were right.

a. $21\overline{)1155}$ *b*. $45\overline{)9585}$ *c*. $52\overline{)1716}$ *d*. $81\overline{)57834}$

8. Explain how to tell where to place the first quotient figure in any example in which you divide two whole numbers.

STUDY HELPS IN DIVISION

1. Jennie has 158 tulip bulbs to plant. She wishes to plant them in equal rows, 12 bulbs to the row. How many rows can she plant? How many extra bulbs will she have?

A.

```
    1
12)158
   12x
   38
```

You know that 158 is 15 tens and 8 ones.

1. THINK: $12\overline{)15} = 1$. Write 1 in tens' place above the 5. (Tell why.)
2. MULTIPLY: 12×1. Write 12. Where?
3. COMPARE: Is 12 less than 15?
4. SUBTRACT: 15 tens − 12 tens = 3 tens.
5. COMPARE: Is the remainder, 3 tens, less than the divisor, 12 tens?
6. BRING DOWN the 8 ones from 158. The 3 tens and 8 ones make 38 ones.

The x shows the number brought down.

B.

```
   13 r2
12)158
   12x
   38
   36
    2
```

Repeat these steps as shown in B. How do we get the 3 in the quotient? Why do we write 3 in ones' place? How do we get the 36? How do we get the 2? What does r2 in the quotient mean?

There will be 13 rows and 2 extra bulbs. How do you check the answer?

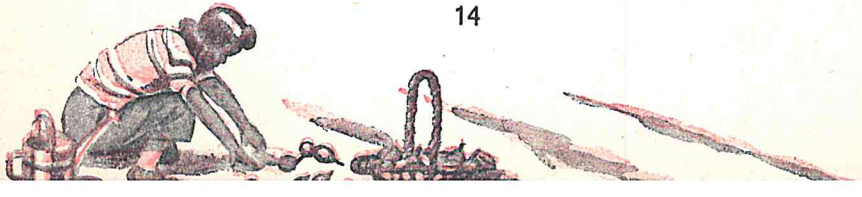
2. If Jennie plants 11 bulbs to the row, how many rows of bulbs can she plant? How many bulbs will she have left?

3. How do you find how many 45's there are in 236?

```
   5 r11
45)236
  225
   11
```

THINK: There are about as many 45's in 236 as there are 4's in 23. $4\overline{)23} = 5$ and a remainder. So there are probably five 45's in 236. Study the work at the left to show that this is correct. Check the answer.

4. How many 67's are there in 473? Check the answer.



FINDING QUOTIENTS IN DIVISION

Study the work below. Then copy the examples and find the answers with your book closed.

	a	*b*	*c*	*d*
1.	3 r1 20)61 60 1	2 r12 36)84 72 12	9 r8 50)458 450 8	3 r4 38)118 114 4
2.	8 r72 91)800 728 72	4 r19 42)187 168 19	6 r12 43)270 258 12	5 r8 34)178 170 8
3.	8 r3 67)539 536 3	2 r1 29)59 58 1	9 r25 74)691 666 25	7 r29 87)638 609 29

PRACTICE IN NAMING QUOTIENTS

Find the quotients. Express remainders with r.

	a	*b*	*c*	*d*	*e*
1.	20)40	40)120	30)60	50)350	70)490
2.	20)84	50)407	40)163	30)97	60)483
3.	20)33	30)47	40)337	90)577	80)791
4.	90)413	20)173	70)600	60)413	40)319
5.	21)84	93)279	92)369	72)218	51)308
6.	31)80	83)271	42)90	67)339	74)191
7.	95)513	56)242	66)281	52)490	68)281
8.	89)374	69)351	97)340	79)414	33)205

THINKING ABOUT MULTIPLICATION

1. In each of the six examples below, the number to be multiplied is the same but the multiplier is different. See if you can arrange the examples in order of the size of the product by estimating the answers. Write first the example whose product you think will be the smallest:

a.	*b.*	*c.*	*d.*	*e.*	*f.*
48	48	48	48	48	48
×9	×16	×5	×69	×20	×37

2. Now find the products to see if you arranged the examples correctly. How can you tell what the order should be?

3. In what way are the six examples below alike?

a.	*b.*	*c.*	*d.*	*e.*	*f.*
75	60	38	54	96	120
×12	×12	×12	×12	×12	×12

4. See if you can arrange the six examples in problem 3 in the order of the size of their products without doing any multiplying other than estimating their answers.

5. Next multiply and find if your order was correct.

6. The six numbers below are the product of 30 and some number. Arrange these six numbers in the order of what you think is the size of the number multiplied by 30 to produce the products. Then check your work by division.

a. 120 *b.* 210 *c.* 630 *d.* 90 *e.* 480 *f.* 360

7. What happens to the size of a product when the same number is multiplied by numbers that become larger?

8. How can you tell what product will be the largest if several different numbers are multiplied by the same number as in problem 3?

9. What does the work in problem 6 show?

10. Find the answer of 6×37 by addition and by multiplication. Check by using division.

11. Find the answer of $24\overline{)96}$ by division and by subtraction. Check by using multiplication.

STUDY HELPS IN DIVISION

Study these examples carefully. Copy and work them with your book closed. Then practice page 19.

1. $31\overline{)682}$ — 22; $62\times$; 62; 62

2. $22\overline{)506}$ — 23; $44\times$; 66; 66

3. $21\overline{)1542}$ — 73 r9; $147\times$; 72; 63; 9

4. $20\overline{)611}$ — 30 r11; $60\times$; 11

5. $32\overline{)6735}$ — 210 r15; $64\times\times$; 33; 32; 15

6. $94\overline{)56776}$ — 604; $564\times\times$; 376; 376

The quotients below are correct. You are to copy and complete the examples. If your final remainders are not the same as those given, you have made errors in either multiplication or subtraction.

	a	*b*	*c*
1.	$94\overline{)692}$ 7 r34	$87\overline{)798}$ 9 r15	$76\overline{)627}$ 8 r19
2.	$83\overline{)1752}$ 21 r9	$42\overline{)512}$ 12 r8	$92\overline{)3423}$ 37 r19
3.	$45\overline{)2393}$ 53 r8	$57\overline{)2425}$ 42 r31	$65\overline{)2240}$ 34 r30
4.	$96\overline{)5307}$ 55 r27	$86\overline{)5428}$ 63 r10	$74\overline{)5438}$ 73 r36
5.	$23\overline{)4725}$ 205 r10	$45\overline{)31537}$ 700 r37	$87\overline{)35326}$ 406 r4

FIVE STEPS TO THE RIGHT ANSWER

It will help you to solve problems if you will ask yourself these five questions about each problem.

I. What does the problem ask me to find? Be sure that you understand what the problem is about. Look for the question that the problem asks.

II. What facts do I need in order to answer the question? Read the problem again to see if the facts needed are given exactly as needed. See if the facts needed are given in the problem itself, in some other problem, in a drawing, table, or some other place on the page. If there is some fact needed to solve the problem that you do not know, look it up.

III. What must I do to find the answer to the question? Decide what processes you must use in working the problem. Sometimes there is more than one step in the work. Sometimes you will not need to work out the example, but will only have to state an answer to the question.

IV. What would be a reasonable answer? If you must work out the example, decide whether the answer will be greater or smaller than some number in the problem. Estimate your answer before you work the problem.

V. Is my answer a reasonable one?

Check your work. Go over your work to find any errors. Compare your answers with your estimate.

Use these five steps in solving the problems below.

1. How tall are you, to the nearest inch?

2. Jim sold 20 dozen apples for $5.00. How much did he receive for a dozen?

3. Three yards of cloth are needed for a dress. How much will the cloth for 10 dresses cost at $.35 a yard?

4. At 15¢ a pint how much does a gallon of cream cost?

GRADED PRACTICE IN DIVISION

Work these examples carefully one row at a time. Go over your work at each step and try not to make any errors. If there is a remainder, express it in the quotient with r. Check your work.

Set I

	a	*b*	*c*	*d*
1.	$33\overline{)693}$	$21\overline{)882}$	$11\overline{)495}$	$42\overline{)882}$
2.	$24\overline{)768}$	$24\overline{)504}$	$34\overline{)714}$	$45\overline{)945}$
3.	$25\overline{)530}$	$43\overline{)946}$	$31\overline{)406}$	$35\overline{)428}$
4.	$33\overline{)1391}$	$75\overline{)3156}$	$92\overline{)3823}$	$64\overline{)2240}$

Set II

1.	$54\overline{)2480}$	$93\overline{)4929}$	$21\overline{)1155}$	$82\overline{)1722}$
2.	$58\overline{)2964}$	$46\overline{)1070}$	$98\overline{)5207}$	$65\overline{)3445}$
3.	$36\overline{)868}$	$85\overline{)6170}$	$95\overline{)6037}$	$63\overline{)1575}$
4.	$93\overline{)2482}$	$56\overline{)2892}$	$77\overline{)1848}$	$86\overline{)4688}$

Set III

1.	$37\overline{)11914}$	$55\overline{)8910}$	$64\overline{)15424}$	$44\overline{)7185}$
2.	$26\overline{)780}$	$67\overline{)22780}$	$88\overline{)61600}$	$78\overline{)62790}$
3.	$12\overline{)490}$	$48\overline{)965}$	$30\overline{)1523}$	$84\overline{)34195}$
4.	$35\overline{)10675}$	$97\overline{)39285}$	$99\overline{)70098}$	$76\overline{)61497}$

MIXED PRACTICE IN DIVISION

1.	$30\overline{)1560}$	$20\overline{)1807}$	$36\overline{)792}$	$24\overline{)750}$
2.	$21\overline{)483}$	$96\overline{)3264}$	$87\overline{)1490}$	$56\overline{)8568}$
3.	$77\overline{)62062}$	$43\overline{)516}$	$74\overline{)4440}$	$64\overline{)2250}$
4.	$82\overline{)4264}$	$57\overline{)17161}$	$11\overline{)496}$	$94\overline{)38164}$

A NEWSLETTER FOR PARENTS

The pupils of the Tuttle School decided to prepare a newsletter for their parents. Each class was to supply news about its work. The sixth grade was to take charge of the newsletter. The problems below tell you about the arithmetic the sixth grade had to do. Use questions I to V on page 18 in solving each problem.

1. The class used 40 mimeograph stencils which cost 11 cents each. How much did the stencils cost?

2. They made 350 copies of the 40-page newsletter. How many sheets of paper were there in these newsletters?

3. They bought 30 packages of paper, each having 500 sheets. How many extra sheets of paper did they have?

4. The paper cost $9.60. How much did a package cost?

5. They used $1\frac{1}{2}$ cans of ink, but had to pay for two cans. The ink cost $1.90 a can. How much did the ink cost?

6. The cost of the stapling of the newsletters was $3.50. Including the cost of the stencils, the paper and the ink, what was the total cost of the newsletters?

7. That night they sold 318 copies of the newsletter at 5 cents each. How much did they receive for the newsletters they sold? Was this as much as the total cost of the newsletters?

8. How much money did the school have to take out of school funds to pay for the newsletter?

*9. If they had sold the newsletter at 10 cents a copy, do you think they would have sold as many copies as they did?

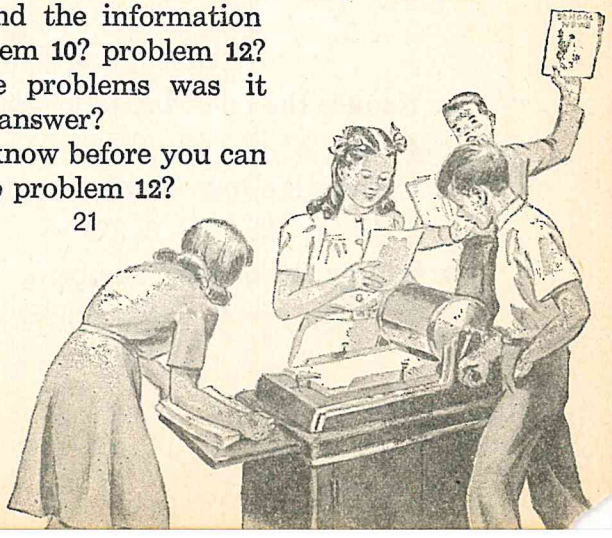
*10. Find local prices for the materials that were needed by the Tuttle School and how much it would cost to prepare the newsletter at local prices.

*11. The school clerk cut the stencils. It took her 10 hours to do so. Would it be fair to include the cost of her time in the cost of the newsletter?

*12. Find the cost of preparing a short newsletter of a few pages for all of the members of your class.

Answering Questions about These Problems

1. Tell what you are to find in each problem. If you try to do this, you will find that the problems will be clearer.
2. Are there any words in the problems that you did not understand? How can you find their meaning?
3. Which of the problems can be solved in one step? Explain.
4. How many steps are there in problem 3?
5. In solving which of the problems did you make use of the answer to one of the other problems?
6. Which problem was solved by using the rule, "The cost of a number of the things is equal to the price of one thing multiplied by the number bought"?
7. Must you use figures to find the answer to problem 9?
8. How can you find the information needed to answer problem 10? problem 12?
9. In which of the problems was it easiest to estimate the answer?
10. What must you know before you can estimate the answer to problem 12?



DIAGNOSTIC TESTS IN FRACTIONS

These tests will help you to find the practice you need in fractions. If you make mistakes on any group of examples, use the study helps on the page and in the row indicated in heavy type.

Addition of Fractions

	a	*b*	*c*			*a*	*b*	*c*	
1.	$\frac{1}{4}$ $\frac{1}{4}$	$\frac{1}{8}$ $\frac{1}{8}$	$\frac{1}{3}$ $\frac{1}{3}$	(25) I	4.	$\frac{5}{8}$ $\frac{4}{8}$	$\frac{2}{3}$ $\frac{2}{3}$	$\frac{3}{4}$ $\frac{3}{4}$	(25) III-IV
2.	$3\frac{1}{8}$ $2\frac{3}{8}$	$5\frac{1}{4}$ $6\frac{1}{4}$	$4\frac{2}{5}$ $7\frac{1}{5}$	(25) II	5.	$6\frac{1}{2}$ $2\frac{1}{2}$	$4\frac{1}{4}$ $5\frac{3}{4}$	$7\frac{1}{3}$ $6\frac{2}{3}$	(26) V
3.	$\frac{1}{2}$ $\frac{1}{2}$	$\frac{1}{4}$ $\frac{3}{4}$	$\frac{2}{3}$ $\frac{1}{3}$	(25) III-IV	6.	$5\frac{3}{4}$ $7\frac{3}{4}$	$8\frac{5}{8}$ $4\frac{7}{8}$	$6\frac{2}{3}$ $8\frac{2}{3}$	(26) VI

Subtraction of Fractions

1.	$\frac{3}{4}$ $\frac{1}{4}$	$\frac{2}{3}$ $\frac{2}{3}$	$\frac{4}{5}$ $\frac{1}{5}$	(28) I	4.	$1\frac{1}{4}$ $\frac{3}{4}$	$1\frac{1}{3}$ $\frac{2}{3}$	$1\frac{5}{8}$ $\frac{7}{8}$	(29) IV
2.	$5\frac{2}{3}$ $3\frac{1}{3}$	$6\frac{5}{8}$ $\frac{1}{8}$	$7\frac{3}{4}$ $5\frac{3}{4}$	(28) II	5.	$5\frac{1}{3}$ $3\frac{2}{3}$	$7\frac{1}{4}$ $4\frac{2}{4}$	$8\frac{2}{5}$ $\frac{4}{5}$	(29) V-VI
3.	3 $1\frac{1}{4}$	5 $4\frac{1}{2}$	8 $\frac{3}{4}$	(28) III	6.	$7\frac{1}{4}$ $6\frac{3}{4}$	$9\frac{3}{8}$ $\frac{5}{8}$	$6\frac{1}{8}$ $5\frac{3}{8}$	(29) V-VI

Reduction of Fractions

1. Reduce the following to lowest terms:

   $\frac{2}{4}$ $\frac{8}{12}$ $\frac{6}{8}$ $\frac{5}{10}$ $5\frac{3}{6}$ $6\frac{4}{8}$ **(23 I)**

2. Express the following in simplest form:

   $\frac{2}{2}$ $\frac{4}{3}$ $\frac{6}{4}$ $7\frac{2}{2}$ $8\frac{5}{4}$ $6\frac{6}{4}$ **(23 II)**

3. Supply the missing numbers:

   $4 = 3\frac{?}{2}$ $1 = \frac{?}{2}$ $1\frac{1}{4} = \frac{?}{4}$ $5\frac{3}{8} = 4\frac{?}{8}$ **(23 III)**

STUDY HELPS IN REDUCTION OF FRACTIONS

I. Reducing Fractions to Lowest Terms.

1. Can the terms of the fraction $\frac{2}{4}$ be divided by any number? Is it expressed in **lowest terms**? How can you tell?

A fraction is reduced to lowest terms when both of its terms can be divided by no other whole number but the number 1. To reduce a fraction to its lowest terms, divide both numerator and denominator by the same number. To reduce $\frac{4}{8}$ to lowest terms divide each term by 4.

$$\frac{4}{8} = \frac{4 \div 4}{8 \div 4} = \frac{1}{2}$$

2. Tell which of the following fractions are reduced to lowest terms. Then reduce all fractions to lowest terms.

$\frac{3}{4}$ $\frac{6}{8}$ $\frac{2}{8}$ $\frac{2}{3}$ $\frac{4}{5}$ $\frac{6}{12}$ $3\frac{5}{10}$ $7\frac{7}{12}$ $9\frac{3}{12}$ $7\frac{2}{4}$

II. Reducing Improper Fractions.

1. Which of these are **improper fractions**? How can you tell? $\frac{2}{2}$, $8\frac{3}{4}$, $\frac{9}{8}$, $6\frac{1}{2}$, $\frac{4}{3}$, $\frac{6}{4}$, $\frac{8}{2}$.

To reduce an improper fraction to simplest form divide the numerator by the denominator. Thus, $\frac{3}{2} = 2\overline{)3} = 1\frac{1}{2}$; $\frac{4}{4} = 4\overline{)4} = 1$; $\frac{6}{4} = 4\overline{)6} = 1\frac{2}{4} = 1\frac{1}{2}$.

2. Express the following in simplest form:

a. $\frac{2}{2}$, $\frac{4}{3}$, $\frac{7}{4}$, $\frac{3}{3}$, $\frac{4}{2}$, $\frac{5}{4}$, $\frac{8}{6}$, $\frac{5}{2}$, $\frac{5}{3}$, $\frac{10}{4}$.

b. $5\frac{2}{2}$, $6\frac{4}{3}$, $8\frac{7}{4}$, $9\frac{4}{4}$, $7\frac{6}{4}$, $5\frac{3}{2}$, $9\frac{7}{5}$, $9\frac{10}{8}$.

III. Changing the Form of Numbers.

1. How many halves are there in a whole? How many fourths? How many eighths? $1 = \frac{?}{2}$; $1 = \frac{?}{4}$; $1 = \frac{?}{8}$.

2. How many fourths are there in $1\frac{1}{4}$? in $1\frac{3}{4}$?

3. Show that $2\frac{1}{4} = 1 + 1\frac{1}{4} = 1\frac{5}{4}$; that $4\frac{3}{4} = 3\frac{7}{4}$.

4. $1 = \frac{?}{3}$; $1\frac{3}{4} = \frac{?}{4}$; $3\frac{1}{4} = 2\frac{?}{4}$; $7\frac{3}{8} = 6\frac{?}{8}$.

CHANGING UNITS OF MEASURE

1. What part of a pound is the weight of an apple that weighs 4 ounces?

THINK: 1 lb. = 16 oz.
4 oz. = $\frac{4}{16}$ lb. = $\frac{1}{4}$ lb. Explain this step.

2. What part of an hour is 20 minutes?

In the examples below you are asked to change the first item to the unit of measure given after it. If you cannot remember some necessary fact, turn to the tables given at the back of the book for help. It will pay you to memorize the important tables of distance, surface measure, liquid and dry measures, time, and weight, since you will use them frequently. Reduce all fractions to lowest terms.

3. 2 qt. = ? gal.
4. 6 in. = ? ft.
5. 4 mo. = ? yr.
6. 2 pk. = ? bu.
7. $\frac{1}{2}$ A. = ? sq. rd.
8. 1 pt. = ? qt.
9. 15 sec. = ? min.
10. 45 min. = ? hr.
11. $\frac{1}{4}$ lb. = ? oz.
12. 2 ft. = ? yd.
13. 6 qt. = ? gal.
14. 40¢ = ? dollar
15. 8 hr. = ? da.
16. 1 cent = ? dollar
17. 10 qt. = ? bu.
18. 3 da. = ? week
19. 48 in. = ? yd.
20. 6 sq. ft. = ? sq. yd.
21. 25¢ = ? dollar
22. 18 = ? doz.
23. 1 pt. = ? gal.
24. 3 sq. ft. = ? sq. yd.
25. 1 dime = ? dollar
26. 500 lb. = ? ton
27. $\frac{1}{8}$ mi. = ? ft.
28. 880 ft. = ? mi.

29. Which of the above are units of value? of distance? of time? of weight? of dry measure? of liquid measure? of surface measure?

STUDY HELPS IN ADDITION OF FRACTIONS

I. Adding Like Fractions.

1. How much is $\frac{1}{4} + \frac{1}{4}$?

$\frac{1}{4}$
$\frac{1}{4}$
$\frac{2}{4} = \frac{1}{2}$

What are the numerators of the two fractions?

To find the sum of the fractions add the numerators of the two fractions. Their sum is 2.

Write 2 over the denominator, 4.

Why do we change $\frac{2}{4}$ to $\frac{1}{2}$? How?

2. Find the sums. Express them in lowest terms.

a.	*b.*	*c.*	*d.*	*e.*	*f.*
$\frac{1}{3}$	$\frac{1}{8}$	$\frac{2}{5}$	$\frac{3}{8}$	$\frac{3}{10}$	$\frac{3}{8}$
$\frac{1}{3}$	$\frac{3}{8}$	$\frac{2}{5}$	$\frac{4}{8}$	$\frac{1}{10}$	$\frac{3}{8}$

II. Adding Mixed Numbers.

1. Find the sum of $2\frac{1}{8} + 3\frac{3}{8}$.

$2\frac{1}{8}$
$3\frac{3}{8}$
$5\frac{4}{8} = 5\frac{1}{2}$

What is the sum of $\frac{1}{8}$ and $\frac{3}{8}$?

How do we get $5\frac{4}{8}$?

Why do we change $5\frac{4}{8}$ to $5\frac{1}{2}$? How?

2. Find the sums. Express them in simplest form.

a.	*b.*	*c.*	*d.*	*e.*	*f.*
$6\frac{1}{4}$	$5\frac{1}{3}$	$3\frac{5}{8}$	$7\frac{3}{8}$	$8\frac{5}{10}$	$9\frac{1}{8}$
$3\frac{1}{4}$	$4\frac{1}{3}$	$2\frac{1}{8}$	$9\frac{3}{8}$	$8\frac{3}{10}$	$3\frac{5}{8}$

III. and IV. Addition With Improper Fractions.

1. Find the sum of $\frac{3}{4}$ and $\frac{3}{4}$.

$\frac{3}{4}$
$\frac{3}{4}$
$\frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$

How do we get $\frac{6}{4}$?

What kind of fraction is $\frac{6}{4}$?

How do we change $\frac{6}{4}$ to $1\frac{2}{4}$?

Why do we change $1\frac{2}{4}$ to $1\frac{1}{2}$?

2. Show that the sum of $\frac{1}{2} + \frac{1}{2}$ equals 1.

3. Find the sums. Be sure they are expressed in simplest form.

a.	*b.*	*c.*	*d.*	*e.*	*f.*
$\frac{1}{2}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{5}{6}$
$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{1}{6}$
$\frac{1}{2}$	$\frac{1}{4}$	$\frac{2}{8}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{3}{6}$

STUDY HELPS IN ADDITION OF FRACTIONS

V. Addition of Mixed Numbers With Carrying.

1. Find the sum of $5\frac{1}{2} + 3\frac{1}{2}$.

$$\begin{array}{r} 5\frac{1}{2} \\ 3\frac{1}{2} \\ \hline 8\frac{2}{2} \end{array} = 8 + 1 = 9$$

How do we get the $8\frac{2}{2}$?
Why is $8\frac{2}{2}$ not the final answer?
Show that $8\frac{2}{2}$ equals $8 + 1$.

2. Find the sums. Be sure they are expressed in simplest form.

a.	*b.*	*c.*	*d.*	*e.*	*f.*
$7\frac{1}{3}$	$6\frac{3}{4}$	$9\frac{1}{2}$	$5\frac{3}{8}$	$6\frac{2}{5}$	$4\frac{1}{10}$
$6\frac{2}{3}$	$7\frac{1}{4}$	$8\frac{1}{2}$	$9\frac{5}{8}$	$8\frac{3}{5}$	$7\frac{9}{10}$

VI. Addition of More Difficult Mixed Numbers.

1. Find the sum of $6\frac{3}{4} + 9\frac{3}{4}$.

$$\begin{array}{r} 6\frac{3}{4} \\ 9\frac{3}{4} \\ \hline 15\frac{6}{4} \end{array} = 15 + 1\frac{2}{4} = 16\frac{2}{4} = 16\frac{1}{2}$$

How do we get the $15\frac{6}{4}$?
How do we change $15\frac{6}{4}$ to $15 + 1\frac{2}{4}$?
Does $15 + 1\frac{2}{4} = 16\frac{2}{4}$?
Why do we change $16\frac{2}{4}$ to $16\frac{1}{2}$?

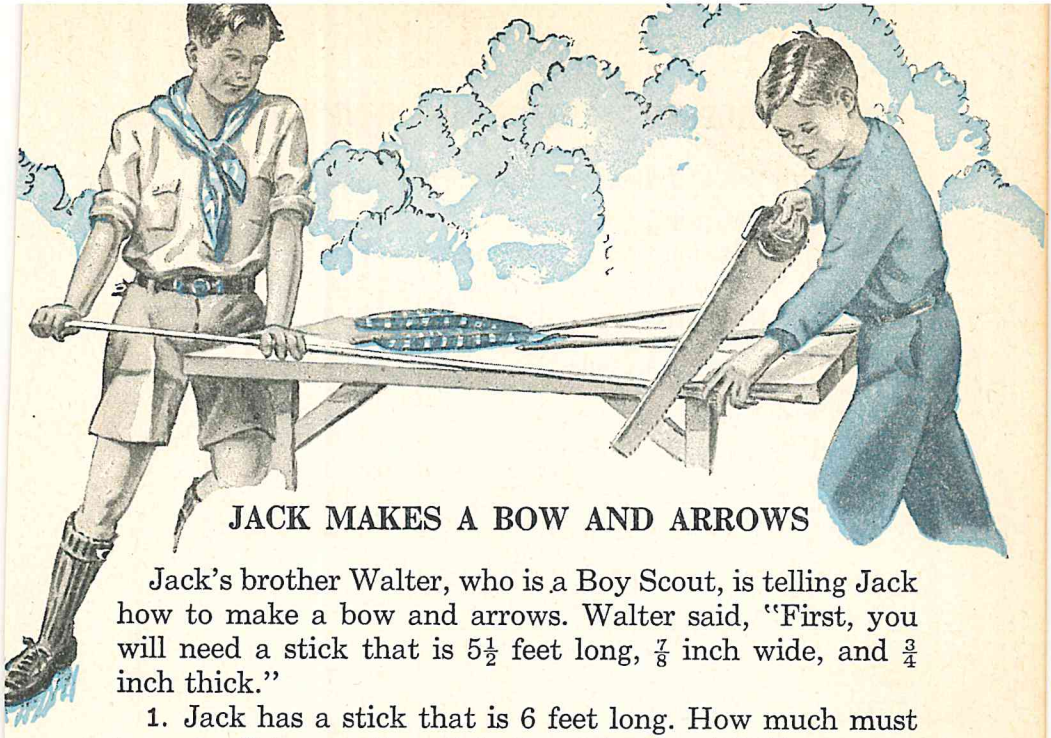
2. Find the sums. Express them in simplest form.

a.	*b.*	*c.*	*d.*	*e.*	*f.*
$8\frac{1}{4}$	$6\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$6\frac{4}{5}$	$3\frac{1}{10}$
$7\frac{3}{4}$	$7\frac{3}{8}$	$7\frac{1}{2}$	$5\frac{3}{4}$	$\frac{4}{5}$	$7\frac{7}{10}$
$5\frac{1}{4}$	$5\frac{4}{8}$	$5\frac{1}{2}$	$\frac{2}{4}$	$8\frac{2}{5}$	$\frac{6}{10}$

MIXED PRACTICE IN ADDITION OF FRACTIONS

Find the sums.

	a	*b*	*c*	*d*	*e*	*f*
1.	$\frac{1}{4}$ $\frac{1}{4}$	$2\frac{1}{3}$ $3\frac{1}{3}$	$6\frac{1}{8}$ $3\frac{5}{8}$	$\frac{1}{8}$ $\frac{3}{8}$	$7\frac{1}{2}$ $8\frac{1}{2}$	$\frac{3}{4}$ $\frac{3}{4}$
2.	$9\frac{3}{4}$ $8\frac{1}{4}$	$\frac{1}{2}$ $\frac{1}{2}$	$\frac{1}{3}$ $\frac{1}{3}$	$6\frac{4}{5}$ $7\frac{3}{5}$	$\frac{5}{8}$ $\frac{5}{8}$	$7\frac{3}{10}$ $5\frac{7}{10}$
3.	$\frac{7}{8}$ $\frac{5}{8}$	$6\frac{7}{8}$ $9\frac{7}{8}$	$9\frac{1}{4}$ $7\frac{1}{4}$	$\frac{9}{10}$ $\frac{7}{10}$	$9\frac{2}{3}$ $8\frac{1}{3}$	$6\frac{3}{4}$ $8\frac{3}{4}$



JACK MAKES A BOW AND ARROWS

Jack's brother Walter, who is a Boy Scout, is telling Jack how to make a bow and arrows. Walter said, "First, you will need a stick that is $5\frac{1}{2}$ feet long, $\frac{7}{8}$ inch wide, and $\frac{3}{4}$ inch thick."

1. Jack has a stick that is 6 feet long. How much must he cut off to get the stick the right length? How many inches must he cut off?

2. His stick is $1\frac{1}{8}$ inches wide. How much too wide is it?

3. If the stick is 1 inch thick, how much too thick is it?

4. If his stick had been $\frac{5}{8}$ inch wide, how much too narrow would it have been?

5. To make the bow and arrows, Jack worked $4\frac{3}{4}$ hours on one day, $2\frac{3}{4}$ hours on another day, and 3 hours on another day. How many hours did he work in all?

6. In a catalogue of sporting goods Jack saw a bow like the one he had made that cost \$6.95. The cost of arrows like the six he had made was 35 cents each. How much would his bow and arrows have cost if he had bought them?

*7. How could Jack be sure not to make his bow too narrow or too thin? How could he measure accurately enough?

STUDY HELPS IN SUBTRACTION OF FRACTIONS

I. Subtracting Like Fractions.

1. How much is $\frac{7}{8} - \frac{1}{8}$?

$$\begin{array}{r} \frac{7}{8} \\ -\frac{1}{8} \\ \hline \frac{6}{8} = \frac{3}{4} \end{array}$$

To subtract like fractions, subtract the two numerators and write the result over the denominator. $7 - 1 = 6$. The denominator of both fractions is 8. So the difference is $\frac{6}{8}$.

Why do we change $\frac{6}{8}$ to $\frac{3}{4}$?

2. Show that $\frac{1}{4} - \frac{1}{4} = 0$.

3. Subtract these fractions:

a.	*b.*	*c.*	*d.*	*e.*	*f.*
$\frac{5}{8}$	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{5}{6}$	$\frac{3}{4}$	$\frac{7}{10}$
$-\frac{3}{8}$	$-\frac{1}{3}$	$-\frac{1}{2}$	$-\frac{1}{6}$	$-\frac{3}{4}$	$-\frac{3}{10}$

II. Subtracting Mixed Numbers.

1. Subtract $6\frac{1}{4}$ from $9\frac{3}{4}$.

$$\begin{array}{r} 9\frac{3}{4} \\ -6\frac{1}{4} \\ \hline 3\frac{2}{4} = 3\frac{1}{2} \end{array}$$

How do we get the $3\frac{2}{4}$?

Why do we change $3\frac{2}{4}$ to $3\frac{1}{2}$?

Show that $3\frac{2}{4} = 3\frac{1}{2}$.

2. Subtract these mixed numbers:

a.	*b.*	*c.*	*d.*	*e.*	*f.*
$6\frac{2}{3}$	$8\frac{3}{4}$	$9\frac{7}{8}$	$1\frac{1}{3}$	$6\frac{5}{8}$	$8\frac{1}{4}$
$-5\frac{1}{3}$	$-4\frac{1}{4}$	$-6\frac{5}{8}$	$-\frac{1}{3}$	$-\frac{1}{8}$	$-5\frac{1}{4}$

III. Subtracting Fractions From Whole Numbers.

1. How much is $4\frac{1}{2}$ subtracted from 8?

$$\begin{array}{r} 8 = 7\frac{2}{2} \\ -4\frac{1}{2} = 4\frac{1}{2} \\ \hline 3\frac{1}{2} \end{array}$$

Why do we change 8 to $7\frac{2}{2}$?

Do we need to change the $4\frac{1}{2}$?

Is the remainder, $3\frac{1}{2}$, correct?

2. Show that $8 - \frac{1}{2} = 7\frac{2}{2} - \frac{1}{2} = 7\frac{1}{2}$.

3. Does $1 - \frac{1}{4} = \frac{3}{4}$? THINK: $1 = \frac{4}{4}$; so $1 - \frac{1}{4} = ?$

4. Subtract these numbers:

a.	*b.*	*c.*	*d.*	*e.*	*f.*
3	7	1	5	7	4
$-1\frac{1}{2}$	$-2\frac{1}{4}$	$-\frac{3}{4}$	$-4\frac{3}{8}$	$-\frac{7}{8}$	$-\frac{1}{2}$

STUDY HELPS IN SUBTRACTION OF FRACTIONS

IV. Subtracting Fractions From Mixed Numbers.

1. How much is $1\frac{1}{4} - \frac{3}{4}$?

$$\begin{array}{r} 1\frac{1}{4} = \frac{5}{4} \\ -\ \frac{3}{4} = \frac{3}{4} \\ \hline \frac{2}{4} = \frac{1}{2} \end{array}$$

You cannot subtract $\frac{3}{4}$ from $\frac{1}{4}$. Why? To change $1\frac{1}{4}$ to $\frac{5}{4}$, THINK: $1 = \frac{4}{4}$; so $1\frac{1}{4} = \frac{5}{4}$. Can you subtract $\frac{3}{4}$ from $\frac{5}{4}$? Does $\frac{2}{4}$ equal $\frac{1}{2}$?

2. Subtract:

a. $1\frac{1}{4} - \frac{2}{4}$ *b.* $1\frac{1}{8} - \frac{3}{8}$ *c.* $1\frac{5}{8} - \frac{7}{8}$ *d.* $1\frac{1}{3} - \frac{2}{3}$ *e.* $1\frac{3}{10} - \frac{7}{10}$ *f.* $1\frac{3}{8} - \frac{5}{8}$

V and VI. More Difficult Subtraction of Fractions and Mixed Numbers.

1. Subtract $3\frac{3}{4}$ from $7\frac{1}{4}$.

$$\begin{array}{r} 7\frac{1}{4} = 6\frac{5}{4} \\ -3\frac{3}{4} = 3\frac{3}{4} \\ \hline 3\frac{2}{4} = 3\frac{1}{2} \end{array}$$

You cannot subtract $\frac{3}{4}$ from $\frac{1}{4}$. So take 1 whole, or $\frac{4}{4}$, from the 7 and change $7\frac{1}{4}$ to $6\frac{5}{4}$. Then subtract. Why is $3\frac{2}{4}$ not the final answer?

2. Show that $5\frac{1}{3} - 2\frac{2}{3}$ is the same as $4\frac{4}{3} - 2\frac{2}{3}$.

3. Subtract the following:

a. $8\frac{1}{4} - 5\frac{3}{4}$ *b.* $6\frac{1}{3} - \frac{2}{3}$ *c.* $5\frac{3}{8} - 2\frac{7}{8}$ *d.* $6\frac{1}{4} - \frac{3}{4}$ *e.* $7\frac{3}{10} - 4\frac{7}{10}$ *f.* $9\frac{2}{5} - 8\frac{3}{5}$

MIXED PRACTICE IN SUBTRACTION OF FRACTIONS

Subtract. Be sure to express the answers correctly.

	a	*b*	*c*	*d*	*e*	*f*
1.	$\frac{3}{8}$ $\frac{1}{8}$	$5\frac{3}{4}$ $2\frac{1}{4}$	$\frac{1}{4}$ $\frac{1}{4}$	7 $2\frac{1}{2}$	$\frac{4}{5}$ $\frac{2}{5}$	$1\frac{1}{4}$ $\frac{3}{4}$
2.	$13\frac{1}{4}$ $4\frac{3}{4}$	$8\frac{1}{2}$ $\frac{1}{2}$	1 $\frac{1}{2}$	$\frac{7}{8}$ $\frac{3}{8}$	$6\frac{2}{3}$ $4\frac{2}{3}$	$6\frac{3}{8}$ $\frac{5}{8}$
3.	$8\frac{7}{10}$ $1\frac{1}{10}$	9 $8\frac{3}{4}$	$\frac{2}{3}$ $\frac{1}{3}$	$6\frac{3}{8}$ $5\frac{7}{8}$	1 $\frac{3}{8}$	$8\frac{1}{4}$ $7\frac{3}{4}$

USING RULES TO SOLVE PROBLEMS

Edward's class has found that the rules given below help them in problem solving. Read each rule carefully. Then write a problem of your own which is solved by using the rule.

1. The cost of a number of items = the price of one item multiplied by the number of items.

EXAMPLE: If one pound of butter costs $.45, how much do 8 pounds of butter cost?

Write another problem of your own solved by this rule.

2. The price of one item = the cost of a number of these items divided by the number of items.

3. The number of items bought = the cost of all of the items divided by the price of one item.

4. The distance traveled = the number of miles traveled in an hour multiplied by number of hours traveled.

5. The speed of traveling an hour = the distance traveled divided by the number of hours traveled.

6. The number of hours traveled = the distance traveled divided by the number of miles traveled in an hour.

7. To change yards to feet multiply the number of yards by 3. Make a rule for changing yards to inches; inches to feet.

8. The area of a rectangle = length times width.

9. The perimeter of a rectangle = 2 times its length plus 2 times its width.

10. Sale price = regular price minus the reduction.

11. To find how many times one number another number is, divide the second number by the first number.

12. To find $\frac{1}{4}$ of a number, divide the number by 4.

HOW TO ESTIMATE ANSWERS

Frank has learned several ways of estimating answers to problems. His methods will help you to estimate answers.

1. In estimating the answer to this addition example Frank said, "The first number is about 6 thousand, the second is about 7 thousand, and the third is about 8 thousand. 6 thousand + 7 thousand + 8 thousand is 21 thousand, or 21,000."

```
 5927
 7046
 8159
21132
```

Then he added the numbers and found that the sum was 21,132. Then he said, "My estimate and the sum are about the same, so my answer is reasonable." Do you think he was right?

2. Frank used this same method to estimate the answer to the subtraction example at the left. Can you show what his method would be? Try it yourself and see if your estimate was about correct.

```
 9156
−2947
```

3. To estimate the answer to the example below in which he multiplies two numbers, Frank proceeds as follows:

```
 815
×39
```

He says, "815 is about 800. 39 is about 40. 800 × 40 is 4 × 8, or 32 with 3 zeros after it. So I estimate that the product will be about 32,000."

Multiply to see if his estimate was reasonable.

4. Tell how you would use Frank's method to estimate the product of the example 41 × 795.

5. To estimate the quotient in this division example, Frank proceeds as follows:

```
54)2485
```

He says, "There will be two figures in the quotient. Since there are only four 5's in 24, I know that the quotient is probably between 40 and 50."

Work the example to find if his estimate was right.

6. Tell how to use Frank's method to estimate the quotient of the example 6198 ÷ 75.

ESTIMATING ANSWERS TO EXAMPLES

After each example there are three numbers. Estimate which of these three numbers is most likely to be the correct answer. List these numbers on your paper. Then work the example to see if your estimate is correct.

1. $4978 + 6992 + 3856 = 15826, 12316, 18206$
2. $\$874.53 - \$294.68 = \$623.75, \$579.85, \$491.85$
3. $6 \times \$45.78 = \$274.68, \$232.08, \$302.68$
4. $80 \times 746 = 59680, 64780, 54280$
5. $3478 \div 74 = 37, 52, 47$
6. $24 \times 58 = 1042, 1392, 1732$
7. $27\frac{1}{2} + 38\frac{1}{2} + 65\frac{1}{2} = 108\frac{1}{2}, 131\frac{1}{2}, 173\frac{1}{2}$
8. $68\frac{3}{4} + 59\frac{3}{4} + 72\frac{1}{4} = 179\frac{3}{4}, 247\frac{3}{4}, 200\frac{3}{4}$
9. $297\frac{1}{4} - 185\frac{3}{4} = 72\frac{1}{2}, 111\frac{1}{2}, 140\frac{1}{2}$
10. $\frac{1}{6}$ of $\$57.72 = \$9.62, \$10.12, \$8.77.$
11. $4982 \div 53 = 104, 94, 74$
12. $63 \times 700 = 40100, 48100, 44100$

For each of the examples below, estimate what the answer will be. Write your estimate on your paper. Then work the example to find the answer. Compare the answer with your estimate. Are you good at estimating answers?

13. $785 + 963 + 845 + 926 =$
14. $\$875.01 - \$286.74 =$
15. $30 \times 395 =$
16. $4982 \div 94 =$
17. $93\frac{3}{4} + 85\frac{3}{4} =$
18. $378\frac{1}{4} - 96\frac{3}{4} =$
19. $\frac{1}{8}$ of $\$57.92 =$

Which is more?

20. 7×68, or 437
21. 9×38, or 322
22. 8×56, or 500
23. 6×47, or 303
24. 5×87, or 427
25. 9×65, or 605

ESTIMATING ANSWERS TO PROBLEMS

Under each problem there are three numbers. Read the problem and make an estimate of what the answer will be. Next, select the one of the three numbers that is nearest your estimate. Then work the problem to see if you selected the correct number for the answer.

1. How much do 65 quarts of milk cost at 12 cents a quart?

   $12.00 $5.40 $7.80

2. If a train goes 924 miles in 22 hours, how many miles does it go on the average in an hour?

   47 mi. 42 mi. 52 mi.

3. A boy spent $3.75 for a pair of football shoes, $4.98 for a suit, and $2.80 for a football. How much did he spend in all?

   $11.53 $9.83 $14.63

4. If I buy 4 loaves of bread at 13 cents a loaf and 2 pounds of butter at 39 cents a pound, how much change should I get from a $5 bill?

   $2.80 $3.70 $4.02

5. What is the distance around a farm that is $1\frac{3}{4}$ miles long and $1\frac{1}{4}$ miles wide?

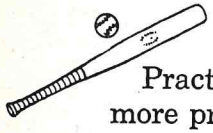
   3 mi. $4\frac{1}{4}$ mi. 6 mi.

Estimate the answers to the following problems. Then find the answers. Are you good at estimating answers?

6. If a bushel of oats weighs 45 pounds, how many bushels are there in a truck load of oats weighing 2,295 pounds?

7. How much do 3 pounds of bacon at 36 cents a pound and 4 dozen eggs at 28 cents a dozen cost?

8. How much less than $96 + 74$ is 5×28?



LET'S PRACTICE

Practice one set of these examples a day. If you need more practice, repeat a set on several days. Keep a record of your scores to see how your work improves.

Set I

1. $\begin{array}{r} 874 \\ 201 \\ 956 \\ 897 \\ 358 \\ \underline{476} \end{array}$

2. $\begin{array}{r} 9780 \\ \underline{-1567} \end{array}$

3. $\begin{array}{r} 578 \\ \underline{\times 9} \end{array}$

4. $8\overline{)4032}$

5. $\begin{array}{r} 427 \\ \underline{\times 36} \end{array}$

6. $32\overline{)6752}$

7. $\begin{array}{r} 9\frac{1}{4} \\ \underline{+8\frac{1}{4}} \end{array}$

8. $\begin{array}{r} 9\frac{3}{4} \\ \underline{-7\frac{1}{4}} \end{array}$

9. $\begin{array}{r} 6\frac{3}{4} \\ \underline{+\frac{3}{4}} \end{array}$

10. $\begin{array}{r} 6\frac{1}{4} \\ \underline{-5\frac{3}{4}} \end{array}$

Set II

1. $\begin{array}{r} 9801 \\ 946 \\ 758 \\ 37 \\ 5984 \\ \underline{987} \end{array}$

2. $\begin{array}{r} 8001 \\ \underline{-5076} \end{array}$

3. $\begin{array}{r} \$9.68 \\ \underline{\times 8} \end{array}$

4. $9\overline{)5166}$

5. $\begin{array}{r} 508 \\ \underline{\times 24} \end{array}$

6. $45\overline{)9135}$

7. $\begin{array}{r} 7\frac{1}{2} \\ \underline{+5\frac{1}{2}} \end{array}$

8. $\begin{array}{r} 8\frac{2}{3} \\ \underline{-7} \end{array}$

9. $\begin{array}{r} 5\frac{3}{8} \\ \underline{+6\frac{1}{8}} \end{array}$

10. $\begin{array}{r} 7\frac{1}{6} \\ \underline{-\frac{5}{6}} \end{array}$

USING THE VOCABULARY OF ARITHMETIC

Arrange the words below in five lists. Use the headings **addition, subtraction, multiplication, division,** and **fractions.** Be ready to tell what each word means.

sum	denominator	product	quotient
remainder	multiplier	reduction	divisor
terms	dividend	difference	numerator

MEASURE YOUR ABILITY TO SOLVE PROBLEMS

This problem scale will help you to find out how well you can solve arithmetic problems.

1. Three nickels, two dimes, and three half dollars are how many cents?

2. On a reading test Patty read 624 words in three minutes. How many words a minute did she read on the average?

3. How many quart bottles will 6 gallons of milk fill?

4. Mary bought 3 pounds of butter at 40 cents a pound and a loaf of bread for 12 cents. How much did she spend?

5. Eight eggs weigh about 1 pound. Find the average weight of one egg.

6. George bought two pieces of meat for his dog. One piece weighed $1\frac{3}{4}$ pounds, the other piece weighed $2\frac{1}{4}$ pounds. How much did the two pieces of meat weigh?

7. If a dozen oranges cost 30 cents, how much does one orange cost?

8. Jane had 6 yards of lace. She cut off two pieces, one $1\frac{3}{4}$ yards long, the other $2\frac{3}{4}$ yards long. How long was the piece of lace that was left?

9. At a $\frac{1}{4}$-off sale John bought a bicycle, the regular price of which was $23.60. Find the sale price of the bicycle.

10. Alice bought $\frac{1}{2}$ pound of butter at 36 cents a pound, 3 dozen eggs at 28 cents a dozen, and 4 quarts of vinegar at 19 cents a quart. How much change should she receive from a five-dollar bill?

What Your Score Means (Number Correct)

Unsatisfactory	Fair	Good	Excellent
0 1 2 3 4	5 6	7 8	9 10

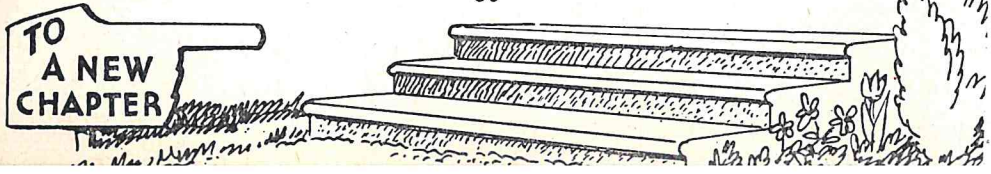
UP THE STEPS TO A NEW CHAPTER

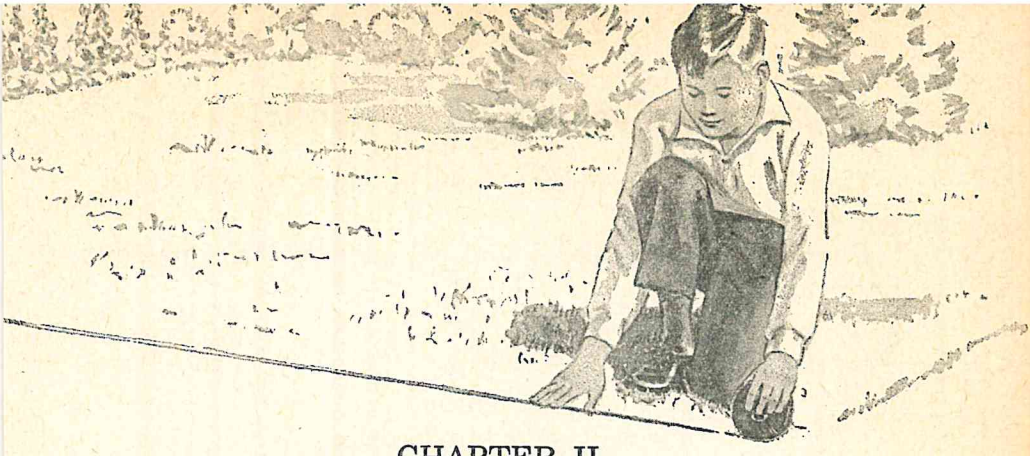
This test will help you to find out how well you can work the different kinds of examples you have studied. When you copy the examples, leave enough space for your work.

1. Add \$37.28, \$.49, \$1.26, and \$297.68. (7)
2. Subtract \$278.94 from \$403.10. (9)
3. How much is 10×32? (12)
4. Find the product of 70 and 96. (12)
5. Multiply \$8.75 by 48. (12)
6. How much is 1617 divided by 40? (14)
7. Divide 3528 by 84. Check your work. (17)
8. Divide 1219 by 53. Check your work. (17)
9. What part of a foot is 8 inches? (24)
10. Find $\frac{1}{4}$ of 96. (11)
11. Reduce to lowest terms: $\frac{15}{20}$, $\frac{16}{24}$, $\frac{20}{50}$. (23)
12. Express in simplest form: $7\frac{2}{2}$, $9\frac{6}{8}$, $8\frac{5}{3}$, $6\frac{6}{4}$. (23)
13. Find the sum of $\frac{5}{8}$ and $\frac{7}{8}$. (25)
14. How much is $3\frac{3}{8}$ plus $6\frac{1}{8}$? (25)
15. $3\frac{1}{2}$ yd. + $4\frac{1}{2}$ yd. = ? yd. (26)
16. Add: $7\frac{3}{4} + 9\frac{3}{4} + 6\frac{1}{4} = ?$ (26)
17. Supply the missing numerators: $4 = 3\frac{?}{4}$; $6\frac{1}{4} = 5\frac{?}{4}$; $1\frac{1}{8} = \frac{?}{8}$. (23)
18. How much more than $7\frac{3}{8}$ pounds is $10\frac{7}{8}$ pounds? (28)
19. Subtract $5\frac{3}{4}$ from 7. (28)
20. How much less than $6\frac{1}{4}$ inches is $4\frac{3}{4}$ inches? (29)

After your paper has been marked, correct your work at once. If you make any errors, turn to the pages given at the right of the test for further practice and study helps.

Do not be satisfied until you can work all of the examples in the test quickly and easily.





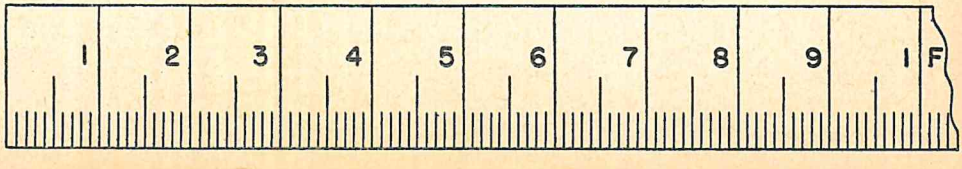
CHAPTER II

WE MEASURE VALUABLE LAND ACCURATELY

Jack's father is a surveyor. The picture at the bottom shows the kind of tape he uses when he measures valuable land. Each foot is divided into 10 parts, each $\frac{1}{10}$ foot long. Each tenth of a foot is divided into 10 parts, making in all 100 parts in each foot. Each part is $\frac{1}{100}$ foot long.

1. What part of a foot is 1 inch?
2. Which is more, $\frac{1}{10}$ foot or 1 inch?
3. Suppose that an inch is divided into eighths. How many eighths of an inch are there in 1 foot?
4. Which is more, $\frac{1}{8}$ inch or $\frac{1}{100}$ foot?
5. Jack used his father's tape measure to find the width and length of the lot on which his house was built. The lot was $36\frac{45}{100}$ feet wide and $124\frac{75}{100}$ feet long. How much longer was the lot than it was wide?
6. What would be the length of a fence built around the whole lot?
7. Jack measured Ann's height and his own height. Ann was $4\frac{45}{100}$ feet tall and Jack was $5\frac{87}{100}$ feet tall. How much taller than Ann was Jack?

*8. Find out what kind of work surveyors do.



WRITING FRACTIONS AS DECIMALS

Do you remember another way in which to write fractions like $\frac{9}{10}$ and $\frac{75}{100}$?

Common fractions like $\frac{9}{10}$ and $\frac{75}{100}$ may also be expressed as **decimal** fractions.

As Common Fractions	As Words	As Decimal Fractions
$\frac{9}{10}$	nine tenths	.9
$\frac{75}{100}$	seventy-five hundredths	.75

When these fractions are expressed as decimals, the denominators 10 and 100 are not written. The word **"decimal"** comes from the Latin word **"decem,"** which means 10. How many 10's are there in 100? How many hundreds are there in 1000? Show that our number system is a decimal system.

We can write $36\frac{45}{100}$ feet as 36.45 feet. This is read: 36 and 45 hundredths feet.

The period in 36.45 is called a **decimal point.** The number 36.45 is called a **decimal.** The number .45 is called a **decimal fraction.** .45 means $\frac{45}{100}$. In reading 36.45, the "and " tells where the decimal point is located. 5.7 is read 5 **and** 7 tenths.

In this book we shall hereafter call common fractions, **fractions;** and decimal fractions, **decimals.**

Read these decimals:

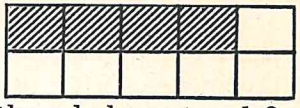
1. .1, .7, .25, .30, .75, .8 yd., .05 gal., .25 lb.
2. 4.2, 5.9, 6.75, 8.09, 4.20, 27.4 ft., 8.01 qt., 19.3 oz.
3. Write the decimals in 1 as fractions. Change the decimals in 2 to mixed numbers.
4. Write as decimals:

a. $\frac{3}{10}$ $\frac{47}{100}$ $9\frac{1}{10}$ $8\frac{17}{100}$ $16\frac{25}{100}$ $18\frac{8}{10}$ $14\frac{20}{100}$.

b. $\frac{4}{10}$ $\frac{15}{100}$ $6\frac{4}{10}$ $9\frac{7}{100}$ $14\frac{9}{100}$ $60\frac{3}{100}$ $90\frac{2}{10}$.

PICTURING DECIMALS

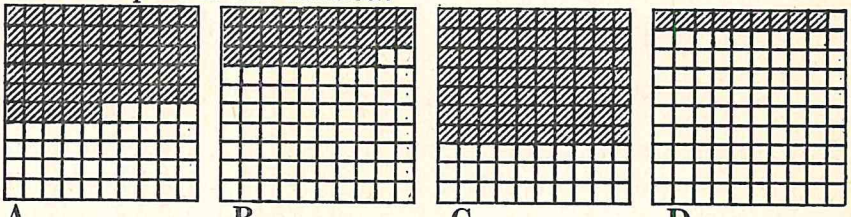
1. What part of the rectangle is each small square? Write your answer in two ways.



2. How many tenths are there in the whole rectangle? Show that 1.0 = 10 tenths.

3. What part of the rectangle is shaded? What part of the rectangle is not shaded? Write your answers in two ways.

4. Draw a rectangle like the one above and shade .7 of it. What part is not shaded?



A B C D

5. What part of each large square is each small square in the squares above?

6. Which of the above squares is .28 shaded? .09 shaded? .70 shaded? .55 shaded?

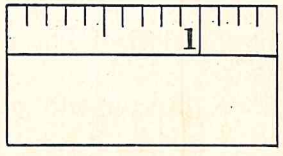
7. What part of each square is not shaded?

8. How many hundredths are there in half of one of the large squares? in one fourth of one of the large squares?

9. How many hundredths are there in one tenth of one large square? in three tenths of a large square?

10. Draw a square. Shade .15 of it.

11. This piece of a ruler is divided into tenths of an inch. How long is it?



12. How much more than 1 inch long is this ruler?

USES OF DECIMALS IN BOOKS AND NEWSPAPERS

Sometimes decimals are used in books and newspapers instead of common fractions. Here are a few samples. Read the sentences.

1. Yesterday 0.42 inch of rain fell.
2. An ocean liner averaged 30.7 miles an hour on a trip.
3. A farmer husked 30.27 bushels of corn in 3 hours.
4. The fare on the railroad was reduced to 2.5 cents a mile.
5. A baby weighed 7.25 pounds when it was born.

*6. Find at least two places in which decimals are used in books and newspapers.

THE DECIMAL POINT IS LITTLE—BUT IMPORTANT

The sentences below are not reasonable because the decimal points in the numbers are not put in where they should be. Copy the sentences, putting in the decimal points. Be ready to tell why your answers are right.

1. An egg weighs 18 ounces.
2. A hat costs $875.
3. Jack is 674 inches tall.
4. A chicken weighs about 575 pounds.
5. The record for running 220 yards is 2075 seconds.
6. An automobile can go about 525 miles in an hour.
7. An airplane flew 575 miles in a minute.
8. The average turkey weighs about 145 pounds.
9. A fast train goes about 105 miles a minute.
10. An automobile goes about 1825 miles on a gallon of gasoline.
11. A farmer can produce 175 bushels of wheat on an acre.
12. An ocean liner can go about 3025 miles in an hour.

ADDING DECIMALS

1. George rode his bicycle 22.3 miles in the morning and 14.5 miles in the afternoon. How far did he ride in all that day?

THINK: 22.3 mi. + 14.5 mi. = ? mi.

$$\begin{array}{r} 22.3 \\ 14.5 \\ \hline 36.8 \end{array}$$

To add decimals begin at the right. In this example first add the tenths, then the ones, then the tens. .5 + .3 is 8 tenths. Write .8 in tenths' place.

4 ones + 2 ones are 6 ones. Write 6 in ones' place.

1 ten and 2 tens are 3 tens. Write 3 in tens' place.

George rode 36.8 miles in all.

2. Show that these sums are correct.

a.	*b.*	*c.*	*d.*
21.5	63.4	71.7	875.4
3.4	27.5	25.2	298.3
24.9	90.9	96.9	1173.7

3. John has two steel bars. One is 9.35 inches long, the other is 7.43 inches long. How long are the two bars?

THINK: 9.35 in. + 7.43 in. = ? in.

$$\begin{array}{r} 9.35 \\ 7.43 \\ \hline 16.78 \end{array}$$

Begin at the right.

First add the hundredths, then the tenths, then the ones.

Show that the sum is correct.

The two bars are 16.78 inches long.

Find the sums:

4. 3.4	5. 6.27	6. 25.3	7. 98.2	8. 59.8
2.5	2.41	47.4	46.1	62.0
9. 6.2	10. 25.3	11. 1.42	12. 17.4	13. 19.3
4.1	16.4	2.56	8.5	20.4

ADDING DECIMALS WITH CARRYING

1. Jane rode her bicycle 3.7 miles one day and 8.6 miles the next day. How far did she ride in the two days?

THINK: 3.7 mi. + 8.6 mi. = ? mi.

First add the tenths, then the ones. .7 + .6 = 13 tenths. This is .3 more than one whole, or 1.3. Write .3. Carry the 1 to the ones' column. 1 + 3 + 8 = 12.

Jane rode 12.3 miles.

$$\begin{array}{r} 3.7 \\ 8.6 \\ \hline 12.3 \end{array}$$

The answer can also be found by changing the decimals to fractions as shown below.

WITH DECIMALS		WITH FRACTIONS
3.7	=	$3\frac{7}{10}$
8.6	=	$8\frac{6}{10}$
12.3		$11\frac{13}{10}$ =
		$11 + 1\frac{3}{10} = 12\frac{3}{10}$

What are the sums? Have they the same value? Which method seems simpler?

2. Show that these sums are correct:

.3	2.6	2.52	1.27	4.73
4.4	.8	1.31	2.48	2.48
4.7	3.4	3.83	3.75	7.21

Find the sums, then check by using fractions.

	a	*b*	*c*	*d*	*e*	*f*
3.	2.6	5.8	8.75	9.86	.8	2.4
	3.1	.6	.68	7.74	1.9	.2
	4.2	7.7	4.52	.80	.7	.3
4.	.3	2.3	5.7	.27	8.04	2.03
	1.4	3.4	6.8	.44	7.15	.04
5.	9.6	1.85	3.7	1.04	.8	5.17
	8.4	2.85	4.8	.96	3.7	2.43

WATCH THIS STEP IN ADDING DECIMALS

Betty said that the sum of .5 + .6 is .11. Ruth said the sum is 1.1. Which sum do you think is right?

1. Ruth used this method to show that 1.1 is correct.

$$.5 = \tfrac{5}{10}$$
$$.6 = \tfrac{6}{10}$$
$$\tfrac{11}{10} = 1\tfrac{1}{10} = 1.1$$

Explain each step in Ruth's work.

You can see that the sum of .6 + .5 is 11 tenths. This is .1 more than 10 tenths or 1 whole. So 11 tenths must be the same as 1.1.

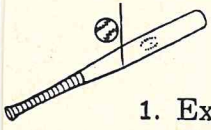
What was wrong with Betty's answer of .11?

Use Ruth's method to prove that these sums are correct:

2.	3.	4.	5.	6.	7.
.7	.1	.27	.9	.25	.03
.6	.4	.86	.8	.75	.05
1.3	.5	1.13	1.7	1.00	.08

Find the sums of the following:

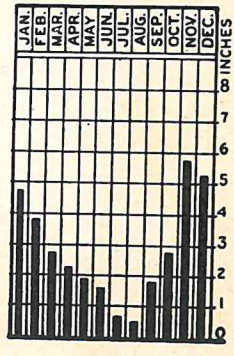
8.	9.	10.	11.	12.	13.
9.8	.3	.25	.08	4.86	.04
8.7	.4	.48	.14	.04	.02
6.5	.7	.19	.75	3.71	.03



LET'S PRACTICE

1. Express as decimals: $\frac{7}{10}$, $3\frac{9}{10}$, $\frac{15}{100}$, $8\frac{1}{100}$.
2. Express as fractions: .3, 4.7, .09, 3.19.
3. Add: 7.5 + 9.7 + 8.6 + 8.4 = ? Check your answer by changing the decimals to mixed numbers and adding them.
4. Find the sum of 8.45, 7.64, 9.83, and .07.

*5. Use the graph to find the rainfall in Seattle for each month and for the year.



THE MEANING OF THOUSANDTHS

In a reference book Daniel read that the speed record for airplanes is 440.681 miles an hour. He saw that this number is a decimal, but he did not know how to read it.

Miss Smith told him that this number is read: 440 and 681 thousandths miles. The decimal .681 is a short way of writing $\frac{681}{1000}$. The number 440.681 could have been written $440\frac{681}{1000}$. Which form is simpler?

1. Read these decimals:

   4.583 .495 86.392 .025 .004 7.102

2. If the numbers were written as fractions, what would each denominator be?

3. Write in decimal form:

   $\frac{377}{1000}$ $\frac{35}{1000}$ $8\frac{403}{1000}$ $\frac{9}{1000}$ $27\frac{16}{1000}$

4. Read: .001 mile is 5.28 feet or 1.76 yards. .01 mile is 52.8 feet.

PLACE VALUE IN DECIMALS

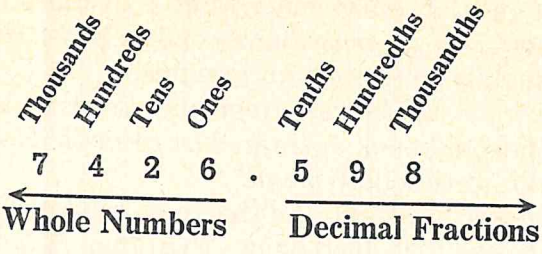
Each figure in the number 7420.689 has a certain value according to the place it holds.

The 7 stands for 7 thousands or	7000.
The 4 stands for 4 hundreds or	400.
The 2 stands for 2 tens or	20.
The 0 stands for 0 ones or	0.
The 6 stands for 6 tenths or	.6
The 8 stands for 8 hundredths or	.08
The 9 stands for 9 thousandths or	.009
	7420.689

In the same way give the value for each figure in the following numbers:

1. 279.6 2. 873.52 3. 9.783 4. 26.981 5. 704.356

HELPS IN READING DECIMALS



The chart above shows you the name of each place in the number 7,426.598.

The places in whole numbers are named to the **left** of the decimal point. Thus, 7426 contains 6 ones, 2 tens, 4 hundreds, and 7 thousands.

The places in decimals are named to the **right** of the decimal point. Thus, .598 contains 5 tenths, 9 hundredths, and 8 thousandths.

The name of the decimal fraction is the same as the name of the place of the last figure. Thus, .15 is read 15 hundredths; .174 is read 174 thousandths.

Read these numbers. Be ready to write them when your teacher reads them.

1. .7, 0.4, .25, .06, .875, .025, .50, 4.02

2.	3.	4.	5.
80.	97.	365.	0.125
8.	9.7	36.5	1.25
0.8	0.97	3.65	12.5
0.08	0.097	0.365	125.

The 0 is often written before decimal fractions like .8 or .08 to make certain that the decimal point is noticed.

6. Which is most: .5, .52, or .527? Which is least?
7. Which is least: .03, .13, or .031? Which is most?
8. Arrange in order of their value: .4, .27, .185, 3.2.

PROBLEMS THAT USE DECIMALS

1. In a race an automobile went 1.25 miles in the first minute and 1.75 miles in the second minute. How far did the automobile go in the two minutes?

2. Jack rode his bicycle from one street to the next in 21.6 seconds and back again in 20.4 seconds. How long did it take him to ride both ways?

3. A worker measured the thickness of two sheets of tin. One sheet was .075 inch thick, the other .127 inch thick. How thick were the two sheets of tin when placed together?

4. One day the temperature was 87.5 degrees at 9 o'clock. It rose 8.0 degrees by noon. How warm was it at noon?

5. At $.35 a dozen how much do 12 dozen eggs cost?

6. Show that a dime ($.10) is $\frac{1}{10}$ of a dollar; that 1 cent ($.01) is $\frac{1}{100}$ of a dollar.

PRACTICE IN ADDING DECIMALS

Find the sums. Be sure to put in the decimal points.

	a	*b*	*c*	*d*	*e*
1.	37.4	3.75	.4	.28	1.275
	46.2	4.86	.6	.45	3.698
	29.1	5.27	.3	.21	4.895
2.	.26	9.73	27.2	.374	8.7
	.48	.85	.6	.482	29.5
	.84	.64	6.5	.276	.6

3. $7.85+9.76+12.84=$
4. $97.8+104.6+29.5=$
5. $.6+1.8+295.4=$
6. $87.25+9.68+.84=$
7. $274.1+9.3+25.8=$
8. $37.865+.004+298.375=$
9. $7.8+9.6+27.4=$
10. $16.83+.84+1.78=$
11. $.875+.976+80.6=$
12. $.4+19.7+286.4=$
13. $3.758+9.864=$
14. $.21+.34+.29=$

DIAGNOSTIC TEST IN UNDERSTANDING OF DECIMALS

If you have difficulty on any part of this test, turn for help to the pages given at the right.

1. Write in words: 3.7; 2.75; 40.025. (38, 44)
2. Write as mixed numbers: 2.1; 4.57; 6.877. (38, 44)
3. Express as decimals: $4\frac{9}{10}$; $16\frac{12}{100}$; $29\frac{8}{1000}$. (38, 44)
4. Write these numbers as decimals: (38, 44)
   a. Fifty-four and twenty hundredths.
   b. Seven and one hundred six thousandths.
5. Which is most, .1, .01, or .001? (45)
6. Which is least, .14, 2.1, or .107? (45)
7. Draw a rectangle. Color .3 of it. What part of the rectangle is not colored? (39)
8. How many tenths are there in 1? How many hundredths? (39)

DIAGNOSTIC TEST IN ADDING DECIMALS

This test will help you to find how well you can add decimals. If you make any errors on the examples in the test, turn for help to the pages given at the right.

	a	*b*	*c*	*d*	*e*	
1.	2.3 4.7	3.97 .85	6.28 1.57	97.8 46.5	8.75 6.25	(42)
2.	.4 .7	.15 .27	.65 .38	.06 .02	.9 .8	(43)
3.	3.375 2.480	97.658 2.974	.869 .985	.065 .398	1.375 .625	(46)

4. 3.7 ft. + 4.1 ft. + 5.1 ft. = (43)
5. .65 hr. + .78 hr. + .82 hr. = (43)
6. 3.758 lb. + .876 lb. + 97.486 lb. = (43)

SUBTRACTING DECIMALS

1. George has ridden his bicycle 8.7 miles. Jane has ridden her bicycle 5.6 miles. How much farther has George ridden his bicycle than Jane has ridden hers?

```
 8.7
-5.6
 3.1
```

THINK: 8.7 mi. − 5.6 mi. = ? mi.
Begin at the right.
7 tenths − 6 tenths = 1 tenth. Write .1.
8 ones − 5 ones = 3 ones. Write 3 in ones' place.
George has ridden 3.1 miles farther than Jane.

2. Show that these subtractions are correct:

a.	*b.*	*c.*	*d.*
29.3	5.8	18.6	473.5
14.2	2.4	9.6	189.2
15.1	3.4	9.0	284.3

3. John is 68.75 inches tall. Ann is 57.43 inches tall. How much taller than Ann is John?

```
 68.75
-57.43
 11.32
```

THINK: 68.75 in. − 57.43 in. = ? in.
Begin at the right. Subtract the hundredths, then the tenths, then the whole numbers.
Show that the subtraction is correct.
John is 11.32 inches taller than Ann.

Subtract these numbers:

4.	5.	6.	7.	8.
29.5	85.9	7.65	21.83	9.475
16.3	27.3	2.41	9.82	3.452

9. How much is 1.1 − .7?

THINK: 1.1 is 10 tenths + 1 tenth, or 11 tenths.
So 1.1 − .7 = 11 tenths − 7 tenths = 4 tenths or .4.

10. 1.2 − .5 =
11. 1.25 − .42 =
12. 1.325 − .172 =
13. 1.6 − .9 =
14. 7.65 − 2.43 =
15. 165.4 − 124.1 =

SUBTRACTING DECIMALS

1. It took Harold 28.5 seconds to swim the length of the swimming pool. It took Jean only 24.6 seconds. How much longer than it took Jean did it take Harold?

$$\begin{array}{r} 28.5 \\ -24.6 \\ \hline 3.9 \end{array}$$

THINK: 28.5 sec. − 24.6 sec. = ? sec.
You cannot subtract 6 tenths from 5 tenths. So take 1 whole or 10 tenths from the 8 and change 5 tenths to 15 tenths.
15 tenths − 6 tenths = 9 tenths. Write .9.
Subtract 24 from 27.
It took Harold 3.9 seconds longer.

2. This example may also be worked by using fractions.

$$\begin{array}{r} 28.5 = 28\frac{5}{10} = 27\frac{15}{10} \\ \underline{-24.6 = 24\frac{6}{10} = 24\frac{6}{10}} \\ 3\frac{9}{10} \end{array}$$

Explain each step in the work.
Does $3\frac{9}{10}$ equal 3.9?
Which method of subtracting do you think is simpler?

Subtract these numbers, first using decimals, then using fractions. Be sure both answers are the same.

	a	*b*	*c*	*d*	*e*	*f*
3.	5.9	7.3	6.8	9.90	6.81	9.72
	2.3	2.1	3.4	4.55	5.21	8.13
4.	10.3	9.1	8.5	8.61	8.41	13.52
	2.5	7.4	3.7	3.53	4.75	4.86

Subtract, using decimals only:

5.	97.4	18.9	.8	48.22	97.51	85.63
	16.5	9.5	.6	26.72	89.62	59.96
6.	348.2	543.5	15.66	48.74	9.065	6.222
	328.5	249.3	8.84	44.77	2.986	1.789

CITY WEATHER RECORD

Temperature Data

Highest yesterday, 61 at 3:20 p. m.
Lowest yesterday, 32 at 12:30 a. m.
Average yesterday, 46.
Normal yesterday, 34.
Departure from normal, +8.
Highest this date last year, 26.
Lowest this date last year, 13.
Highest this date, 64.
Lowest this date, 0.

Sun and Moon

Rises 7:10 a. m.; sets 4:46 p. m.

Moon (Phase) New Moon

Rises 10:13 a. m.; sets 7:56 p. m.

Precipitation Data

Total this month to date, .01.
Departure from normal, —.63.
Total since January 1, 23.52.
Departure from normal,—2.53.
Normal this month, 1.27.
Greatest this month, 4.06 in 1918.
Least this month, .06 in 1917.
Barometer 6 p. m. yesterday, 29.45; 6:30 a. m. today, 29.29.
Relative humidity, 6:30 p. m. yesterday, 46; 6:30 a. m. today, 60.
Wind, 6:30 p. m. yesterday, south, 8 miles; 6:30 a. m. today, south southwest, 9 miles.

WEATHER RECORDS

Each day the United States Weather Bureau publishes much information about the weather. See the chart at the left.

1. What was yesterday's highest temperature? the lowest temperature? the average temperature?

2. Was the average temperature above or below normal? How much?

3. The + before the 8 shows that the average temperature was above normal. What would a departure from normal of −8 show?

4. Find the difference between the highest and lowest temperature on this date "last year;" on "this date."

5. How long was it from sunrise to sunset?

6. How much rainfall had there been this month? How much less than the normal (usual) rainfall was this?

7. How much rain had fallen since January 1? How much below normal was this amount?

8. Find the difference between the greatest and least amounts of rain that had fallen in "this month."

*9. How much lower than "yesterday" was the barometric reading "today"? What does barometric reading show?

*10. How much lower was the humidity "yesterday" than "today"? Was it more likely to rain "today"?

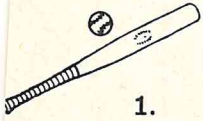
THE CLASSROOM WEATHER BUREAU

Miss Archer's room has a weather bureau. Each day one pupil records the temperature at 9 o'clock, 12 o'clock, and 3 o'clock; another pupil the wind direction; another the air pressure as shown by the barometer; and another the amount of rainfall, or precipitation. The children keep these records carefully and accurately. They hope to answer these questions:

1. What are the prevailing winds where we live?
2. From what direction does the wind blow on cloudy days?
3. Is the air pressure heavy or light on cloudy days?
4. Does the temperature rise or fall on clear days?

Perhaps your class can have a weather bureau of its own and keep the same records that Miss Archer's pupils did. Are there questions that you would like to add to the list?

LET'S PRACTICE



	a	*b*	*c*	*d*	*e*
1.	$\begin{array}{r} 2\frac{2}{3} \\ +\frac{2}{3} \\ \hline \end{array}$	$\begin{array}{r} 8\frac{1}{2} \\ -5 \\ \hline \end{array}$	$40\overline{)1897}$	$\begin{array}{r} 5\frac{1}{4} \\ +6\frac{1}{4} \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -2\frac{3}{4} \\ \hline \end{array}$
2.	$\begin{array}{r} 6\frac{3}{4} \\ -2\frac{1}{4} \\ \hline \end{array}$	$\begin{array}{r} 765 \\ \times 98 \\ \hline \end{array}$	$\begin{array}{r} 7\frac{7}{8} \\ +4\frac{5}{8} \\ \hline \end{array}$	$73\overline{)4672}$	$\begin{array}{r} 6\frac{1}{2} \\ +\frac{1}{2} \\ \hline \end{array}$
3.	$\begin{array}{r} 5.48 \\ -2.75 \\ \hline \end{array}$	$\begin{array}{r} 6\frac{1}{3} \\ +\frac{1}{3} \\ \hline \end{array}$	$\begin{array}{r} 7084 \\ \times 80 \\ \hline \end{array}$	$\begin{array}{r} 9\frac{1}{4} \\ -4\frac{3}{4} \\ \hline \end{array}$	$\frac{1}{8}$ of 160 =

4. Add: 7.5 + 8.6 + 9.1 + 0.1 =

USING ZERO IN SUBTRACTING DECIMALS

1. One morning .56 inch of rain fell. That afternoon .50 inch fell. How much more rain fell in the morning than in the afternoon?

$$\begin{array}{r} .56 \\ -.50 \\ \hline .06 \end{array}$$

In this example there is a zero difference in tenths' place in the answer. .56 − .50 = .06. Write the zero to hold the tenths' place. Because you are subtracting hundredths the answer must be hundredths.

.06 inches more rain fell in the morning.

2. Study carefully the work below. Check by addition.

a.	*b.*	*c.*	*d.*	*e.*
.51	.485	.394	.100	.10
−.47	−.479	−.375	−.009	−.04
.04	.006	.019	.091	.06

3. Copy and work the examples in 2. Check by addition.

4. A tin worker wanted a sheet of tin .075 inch thick. He measured a sheet that was .128 inch thick. How much too thick was this sheet?

Subtract the following. Check by addition:

	a	*b*	*c*	*d*	*e*
5.	.25	.475	.49	.993	.265
	.21	.396	.42	.981	.259
6.	2.65	9.1	8.476	65.76	25.31
	2.59	8.4	8.391	49.78	24.91

MIXED PRACTICE WITH DECIMALS

1.	5.4	.78	8.65	9.836	9.854
	+7.9	−.54	+9.27	−2.795	+2.763
2.	6.5	5.6	.003	.597	3.64
	−2.7	+7.4	+.004	−.592	−3.59

DIAGNOSTIC TEST IN SUBTRACTING DECIMALS

This test will help you to find how well you have learned to subtract decimals. If you make more than one mistake in a row of examples, turn for help to the pages given at the right. Then correct your errors.

	a	*b*	*c*	*d*	*e*	
1.	2.7	3.95	26.9	97.85	17.985	(48)
	1.5	1.48	14.5	48.96	8.596	(49)
2.	.26	.5	.698	.78	.597	(49)
	.14	.3	.299	.26	.488	
3.	.27	.356	.005	.45	.981	(52)
	.23	.328	.001	.38	.974	

4. Subtract and check: 96.76 − 25.49 = (48)
5. Subtract and check: 157.296 − 1.875 = (49)
6. Subtract these numbers first with decimals and then with fractions: 91.7 − 2.5 = (49)

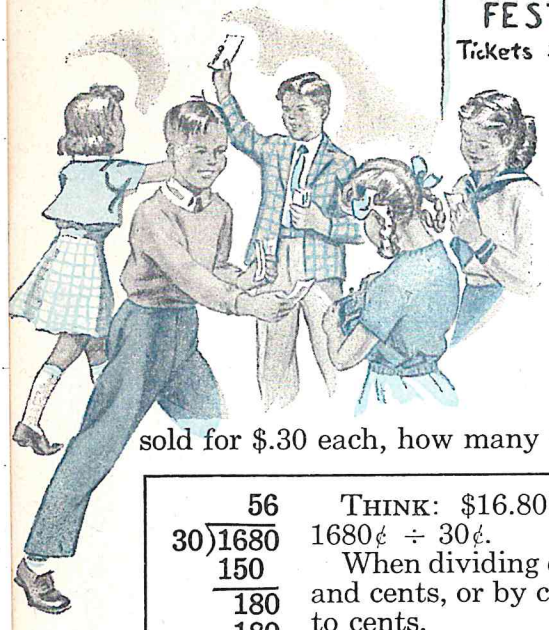
Checking Up

1. Repeat the test on reading and writing decimals on page 47.
2. Repeat the diagnostic test on addition of decimals on page 47.

*INTERESTING FACTS TO FIND OUT

If you do not need more practice on adding and subtracting decimals, you may prepare a special report on one of the topics given below.

1. How a weatherman forecasts the weather.
2. The normal rainfall in our state each month.
3. The use of decimals in industry.
4. The Dewey decimal system used in libraries.



DIVIDING DOLLARS AND CENTS

The children are selling tickets for the Harvest Festival. The money is to be used to buy playground equipment.

1. The sixth grade received in all $16.80 for the tickets sold. If the tickets sold for $.30 each, how many tickets did the class sell?

$$\begin{array}{r} 56 \\ 30\overline{)1680} \\ 150 \\ \hline 180 \\ 180 \\ \hline \end{array}$$

THINK: $16.80 ÷ $.30 is the same as 1680¢ ÷ 30¢.

When dividing dollars and cents by dollars and cents, or by cents, change both numbers to cents.

The class sold 56 tickets.

2. The fourth grade received in all $20.10 for the tickets they sold. How many tickets at $.30 each did the class sell?

3. $34.20 ÷ $.76 = 4. $44.16 ÷ $.96 = 5. $204.80 ÷ $.32 =

6. $46.80 ÷ $.60 = 7. $66.25 ÷ $.53 = 8. $379.68 ÷ $.42 =

LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	$4\frac{1}{4}$ $+6\frac{3}{4}$	1250 ×50	$20\overline{)843}$	$9\frac{3}{4}$ $+8\frac{3}{4}$	97.5 +26.4
2.	$\frac{1}{4}$ of 172 =	7 $-4\frac{1}{4}$	$6\frac{1}{8}$ $+9\frac{3}{8}$	648 ×37	$6\frac{2}{3}$ $-2\frac{2}{3}$
3.	$43\overline{)18215}$	$1\frac{1}{8}$ $-\frac{5}{8}$	$5\frac{1}{2}$ $+6\frac{1}{2}$	$8\frac{1}{6}$ $-2\frac{5}{6}$	65.3 −27.9

MULTIPLYING BY 10 AND 100

1. How much do 10 chickens weigh if their average weight is 5 pounds?

THINK: $10 \times 5 = ?$ lb.

Tell a quick way in which to multiply any number by 10. How much are 4 tens? 7 tens? 12 tens?

2. How much is 10×6? 10×17? 10×204?

3. How much do 100 chickens weigh if their average weight is 5 pounds?

THINK: $100 \times 5 = 1$ hundred $\times 5$, or 5 hundred, or 500.

4. How much is 100×6? 100×7?

5. Write the figure 4 on your paper. Now write two 0's after the 4. This gives 400. How many times 4 is 400?

You can see that an easy way to multiply a number by 100 is to write two 0's after the number.

6. Show that $800 = 100 \times 8$; that $900 = 100 \times 9$.

Give the products:

	a	*b*	*c*	*d*
7.	$100 \times 2 =$	$100 \times 7 =$	$100 \times 25 =$	$100 \times 70 =$
8.	$100 \times 3 =$	$100 \times 4 =$	$100 \times 46 =$	$100 \times 857 =$

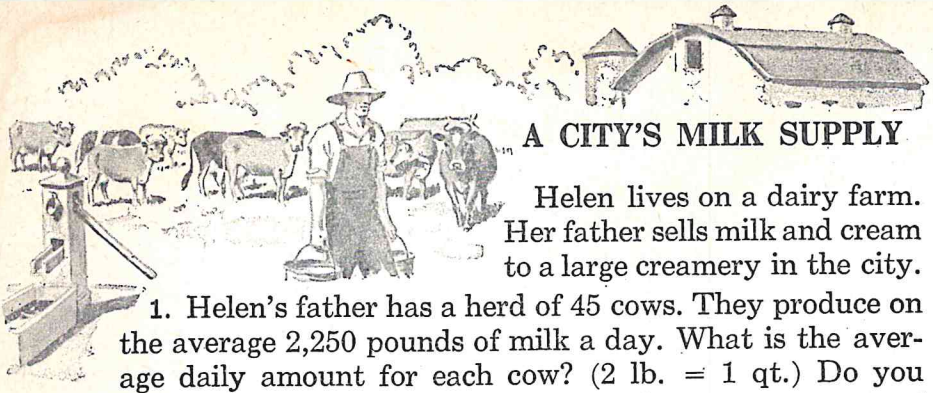
9. How much is 200×43?

THINK: 2 hundreds $\times 43 = 86$ hundreds, or 8600.

10. Another way to work this example is shown below. 200×43 is the same as $2 \times 100 \times 43$; or 2×4300, which is 8600. Explain each step in the work.

Find the products:

	a	*b*	*c*	*d*
11.	$200 \times 34 =$	$200 \times 82 =$	$200 \times 75 =$	$800 \times 21 =$
12.	$300 \times 74 =$	$300 \times 26 =$	$400 \times 28 =$	$400 \times 73 =$
13.	$500 \times 63 =$	$600 \times 48 =$	$700 \times 21 =$	$800 \times 42 =$
14.	$600 \times 52 =$	$700 \times 41 =$	$500 \times 27 =$	$900 \times 23 =$



A CITY'S MILK SUPPLY

Helen lives on a dairy farm. Her father sells milk and cream to a large creamery in the city.

1. Helen's father has a herd of 45 cows. They produce on the average 2,250 pounds of milk a day. What is the average daily amount for each cow? (2 lb. = 1 qt.) Do you think that all of the cows produce the same amount of milk as the average?

2. Helen has a pet Jersey cow that produces 5.3 pounds of butterfat to each 100 pounds of milk. Her brother George has a pet Holstein that produces 3.7 pounds of butterfat to each 100 pounds of milk. How much more butterfat to 100 pounds of milk does the Jersey produce than the Holstein produces?

3. The Jersey cow produces about 50 pounds of milk a day, the Holstein about 80 pounds of milk. How much more milk does the Holstein produce in a week than the Jersey produces?

4. In February Helen's father received 3.75 cents a pound for the milk at the creamery, in August 2.65 cents a pound. Find the difference in the prices he received a pound.

5. A good cow produces about 50 pounds of milk a day. Allowing 1 pound of milk a day for each person, how many cows would it take to supply the milk for one day for a city of 150,000 people?

6. Helen's father is paid about $5\frac{3}{4}$ cents a quart for the milk. It is sold in the city for 11 cents a quart. How much more a quart do the people in the city pay than Helen's father receives?

*7. Why is there a difference in these two amounts?

A SHORT WAY TO MULTIPLY WITH ZEROS

1. How much do 300 pairs of shoes cost at $2.65 a pair? To find the cost you must multiply $2.65 by 300.

A short way of working this problem is shown below.

A.	$2.65 ×300 00	First write two 0's in ones' and tens' places in the product, to show that you are multiplying by hundreds. (See **A.**)
B.	$2.65 300 $795.00	Now multiply 265 by 3. The product is 79,500 cents. (See **B.**) Since this can be changed to dollars, point off two places. The result is $795.00. 300 pairs of shoes cost $795.00.

2. Study the work below. Be ready to explain each product. Then copy the examples without the work and find the products.

a.	*b.*	*c.*	*d.*
327 ×300 98100	408 ×400 163200	$5.40 ×600 $3240.00	$7.00 ×500 $3500.00

3. At $1.25 each how much do 200 baseballs cost?

4. At $.25 each how much do 400 movie tickets cost?

Find the products of the following, using the method shown above.

	a	*b*	*c*	*d*	*e*	*f*
5.	125 ×200	469 ×300	407 ×400	690 ×700	795 ×900	400 ×200
6.	965 ×400	805 ×500	673 ×200	807 ×300	940 ×560	937 ×800
7.	$3.20 ×300	$6.00 ×800	$7.46 ×600	$3.28 ×400	$8.09 ×200	$8.00 ×700
8.	$9.08 ×600	$7.52 ×700	$7.63 ×500	$7.58 ×800	$5.32 ×600	$8.64 ×900

MULTIPLYING BY THREE-PLACE NUMBERS

1. An Iowa farmer has a drove of 236 hogs. He thinks that their average weight is about 195 pounds. Find the total weight of the hogs.

THINK: 236 × 195 lb. = ?

Here is one way to work this example:

$6 \times 195 = 1170$
$30 \times 195 = 5850$
$200 \times 195 = 39000$
$\text{Total} = 46020$

Explain each step in the work at the left. How do we get the 46020? The hogs weighed 46,020 lb.

2. Here is a shorter way to work this example:

```
  195
 ×236
 1170
 5850
39000
46020
```

Multiply 195 by 6. Write 1170.
Multiply 195 by 30. Write 5850.
Then multiply 195 by 200. Write 39000.
Be sure to write the partial products so that all of the ones, the tens, the hundreds, etc., are placed correctly. Then find the sum of the partial products.

3. Study the examples below. Then copy the examples without the work and find the answers. Check your work with the work below.

a.	*b.*	*c.*
427	208	740
×537	×682	×419
2989	416	6660
12810	16640	7400
213500	124800	296000
229299	141856	310060

Multiply. Check each answer by going over your work.

	a	*b*	*c*	*d*
4. Multiply by 273:	159	936	5872	$67.48
5. Multiply by 419:	748	285	6709	$56.93
6. Multiply by 586:	561	604	8937	$87.29

WATCHING ZEROS IN MULTIPLICATION

1. At \$6.08 each how much do 405 school desks cost?

\$6.08
405
3040 (5×608)
243200 (400×608)
\$2462.40

THINK: 405 × \$6.08 = ?
First multiply \$6.08 by 5. There are no tens to multiply by. This is shown by the 0 in 405. So multiply \$6.08 by 4 hundreds, or 400.
Be sure to place the numbers correctly.
Then add the partial products.
The seats cost \$2,462.40.

2. Study carefully the work below. Then copy the examples without the work and find the answers.

a.	*b.*	*c.*	*d.*
729	462	840	907
×405	×370	×602	×180
3645	32340	1680	72560
291600	138600	504000	90700
295245	170940	505680	163260

3. How much do 307 desks cost at \$5.90 each?

	a	*b*	*c*	*d*	*e*	*f*
4.	368	907	596	297	763	480
	×504	×307	×260	×504	×908	×810
5.	968	473	480	250	860	790
	×780	×206	×602	×450	×970	×180
6.	853	529	536	597	841	462
	×730	×890	×108	×790	×809	×703

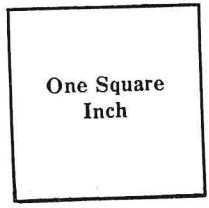
MIXED PRACTICE IN MULTIPLICATION

1.	685	58	594	208	845	203
	×9	×80	×76	×504	×213	×600
2.	867	435	749	796	769	796
	×670	×45	×9	×302	×18	×450

HOW TO MEASURE AREA

To make a safety poster, Helen has her choice of two pieces of cardboard. One is 18 inches long and 12 inches wide. The other is 20 inches long and 10 inches wide. Helen wants to use the larger piece. Which will she take?

To find out, compare the **areas** of the two pieces.



1. One of the units for measuring area is the **square inch.** It is a square 1 inch long and 1 inch wide. Cut out one such square.

2. Draw a rectangle 3 inches long and 2 inches wide. How many inch squares will it take to cover this rectangle? To find out, either divide it into square inches, or cover it with inch squares.

3. We say that the area of the rectangle in 2 is 6 square inches. How many rows of squares, 3 to a row, are there? 2×3 square inches $=$? square inches.

4. How many square inches are there in a square that has 4 rows of 4-inch squares each? 4×4 square inches $=$? square inches.

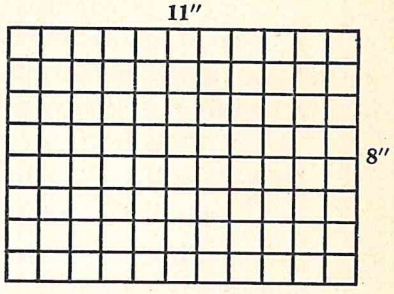
An easy way to find the area of a surface is to multiply the length by the width, using the same unit of measure. Thus, a rectangle whose length is 5 inches and its width 4 inches has an area of 5×4, or 20 square inches.

5. Use this rule to find the area of a rectangle 3 inches by 4 inches. Then use your inch squares to show that the rule is right.

Find the areas of the following rectangles:

6. 8 in. by 4 in.
7. 7 in. by 5 in.
8. 9 in. by 6 in.
9. 15 in. by 10 in.
10. 25 in. by 48 in.
11. 16 in. by 20 in.
12. 20 in. by 18 in.
13. 30 in. by 40 in.
14. 50 in. by 60 in.
15. Which piece should Helen take? Why?

LARGER MEASURES FOR LARGER AREAS



1. John's new picture is 11 inches long and 8 inches wide. What is the area of the picture?

THINK: **area = length × width.**
11 in. × 8 in. = ? square inches.

2. On the blackboard draw and label a square one foot on each side. This is a **square foot.** How much larger is this than John's picture in problem 1?

3. Mary said that their lot at home is 60 feet wide, and 150 feet deep (long). How many square feet are there in this lot?

4. **A square yard is a square one yard long and one yard wide.** Draw a picture of a square yard on the blackboard.

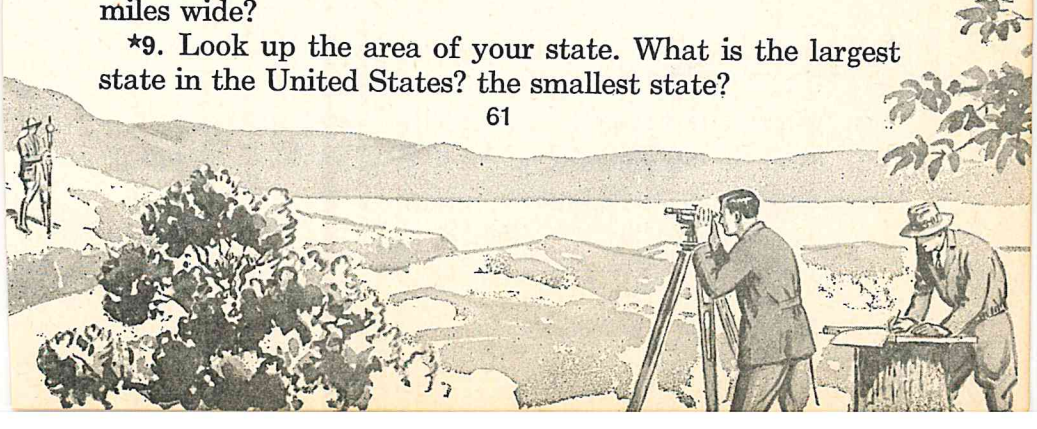
5. How many square yards are there in a rug 10 yards long and 5 yards wide?

6. Farms are measured by the **acre.** An **acre** is equal to a square piece of ground approximately 208 feet on a side. How many square feet of ground does this make?

7. The actual number of square feet in an acre is 43,560. How much less than this is the area of a 208-foot square?

8. States and countries are measured by the **square mile.** What is the area of a state 225 miles long and 150 miles wide?

*9. Look up the area of your state. What is the largest state in the United States? the smallest state?



COMPARING UNITS OF MEASURE

1. A square, each of whose sides is 1 foot long, contains how many square inches? THINK: 1 ft. × 1 ft. = 12 in. × 12 in. = ?, the number of square inches in a **square foot.**

2. How many square feet are there in a square, each of whose sides is 1 yard long? THINK: 1 yd. × 1 yd. = 3 ft. × 3 ft. = ?, the number of square feet in a **square yard.**

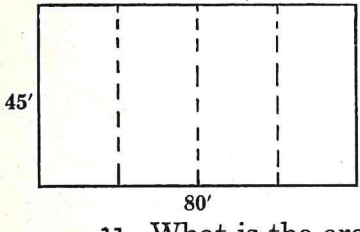
3. Since early times a unit of length called the **rod** has been used. A rod is $16\frac{1}{2}$ feet long. An **acre** contains 160 square rods. Does a field 10 rods wide and 16 rods long contain an acre?

4. How many acres are there in a **square mile?** What other name is there for this area?

PRACTICE IN FINDING AREAS

Find the areas of these rectangles:

1. A room, 25 ft. × 18 ft.
2. A picture, 20 in. × 32 in.
3. A rug, 15 yd. × 10 yd.
4. A garden, 300 ft. × 200 ft.
5. A state, 300 mi. × 250 mi.
6. A hall, 400 ft. × 275 ft.
7. A theater, 275 ft. × 105 ft.
8. A lawn, 16 yd. × 40 yd.



9. The drawing at the left represents a garden. Find the area of the garden.

10. The garden is divided into four equal parts. What are the dimensions of each part?

11. What is the area of each part of the garden?

*12. Find the dimensions of the floor of your classroom to the nearest foot. Then find its area.

A GAME WITH UNITS OF MEASURE

1. Which of the following has an area nearest a square inch? a square foot? a square yard? an acre?

a. a desk top *b*. a city block *c*. a stamp *d*. a handkerchief

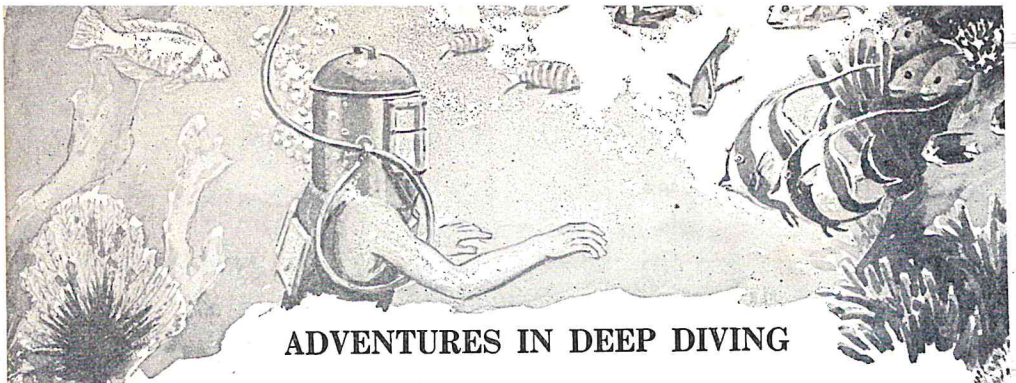
2. What unit of measure would be the best to use in measuring each of the following items? Be ready to explain why.

a. The weight of an egg.
b. The area of a garden.
c. The milk in a large can.
d. The area of a farm.
e. The time it takes to swim 25 yards.
f. The speed of an airplane.
g. The area of a rug.
h. The area of an ink blotter.
i. The dimensions of a room.
j. The area of a country.
k. The cost of a stamp.
l. The length of a sidewalk.
m. The amount of corn produced on a farm.
n. The amount of rainfall.
o. The weight of a load of hay or coal.

LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	$9.68 - 5.94$	$6\frac{3}{4} + 7\frac{3}{4}$	$7\frac{1}{4} - 2\frac{1}{4}$	$30\overline{)287}$	420×300
2.	$8\frac{3}{8} - 2\frac{7}{8}$	597×608	$57.6 - 57.4$	$8\frac{1}{2} + 5\frac{1}{2}$	$.295 + .186$
3.	$6\frac{1}{4} + \frac{1}{4}$	$83\overline{)3901}$	$9 - 2\frac{1}{2}$	684×750	$54\overline{)32886}$

4. Add: $796 + 4872 + 51 + 987 =$



ADVENTURES IN DEEP DIVING

David is much interested in deep sea diving and submarines. He made a report to the class about dangers of diving. The table at the right is the one he put on the blackboard. It shows the pressure above the usual air pressure on each square inch of a diver's body at various depths below the surface of the water.

Depth in Feet	Pressure per Square Inch
33	14.7 lb.
66	29.3 lb.
99	44.0 lb.
132	58.7 lb.
165	73.4 lb.
198	88.1 lb.
210	94.0 lb.
231	102.8 lb.

1. What is the pressure on each square inch of a diver's body at a depth of 33 feet? of 231 feet?

2. Sponge divers in the Mediterranean work at a depth of about 132 feet. What is the pressure at this depth?

3. If a submarine goes from a depth of 33 feet to a depth of 99 feet, how much does the pressure on each square inch of its hull increase? Why would it be dangerous for a submarine to go to a depth of 500 feet?

4. If a diver in a diver's suit works on a wreck at a depth of 240 feet, about how many pounds a square inch is the pressure? Use David's table to make an estimate.

*5. The greatest depth at which useful work can be done by divers is 300 feet. Explain why it would be very difficult to work at greater depths.

DIAGNOSTIC TEST IN MULTIPLICATION

This test will help you to find how well you have learned to multiply by three-figure multipliers. If you make more than one error in a row of examples, turn for help to the page given at the right of the row. Then correct your work.

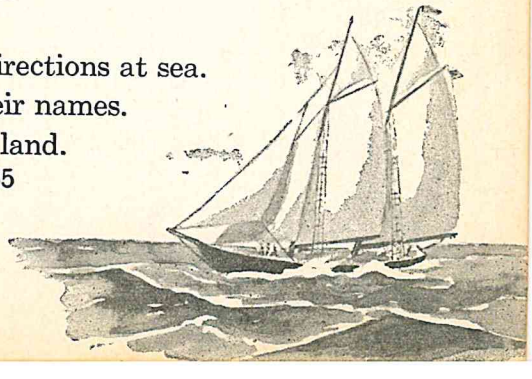
1. How much is 100 × 7? 100 × 24? 100 × 356? (55)

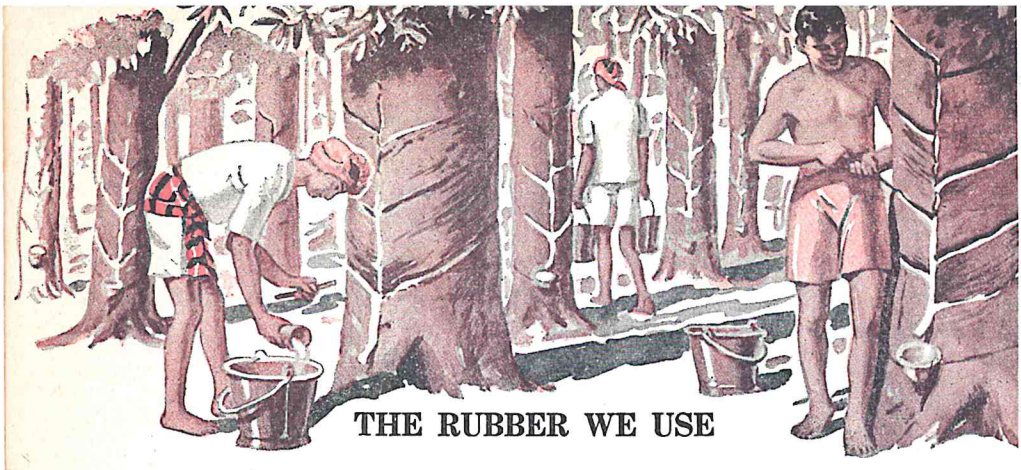
	a	*b*	*c*	*d*	*e*	
2.	245 ×300	579 ×400	607 ×500	740 ×600	800 ×900	(57)
3.	396 ×384	759 ×976	804 ×462	860 ×817	3462 ×259	(58)
4.	204 ×708	905 ×105	870 ×308	306 ×608	2730 ×709	(59)
5.	845 ×750	862 ×640	907 ×520	950 ×260	5609 ×970	(59)

*INTERESTING FACTS TO FIND OUT

If you do not need to practice on multiplication, you may look for information about one of the topics given below.

1. How screen for windows is sold.
2. How glass for windows is measured and sold.
3. The height of interesting waterfalls in the world.
4. The distance to the stars.
5. The work of surveyors.
6. How the mariner tells directions at sea.
7. How the months got their names.
8. How surveyors measure land.





THE RUBBER WE USE

1. Rubber was discovered by the natives of South America long before white men came to this country. It is said that Columbus gave a rubber ball made by the Indians to Queen Isabella on his return from his second voyage to the New World in 1497. How many years ago was this?

2. Rubber is made from the sap (called latex) of a tree. This tree grows to a height of from 60 feet to 75 feet. Point to some tree where you live that is about this high. Can you name a tree that grows higher? that does not grow as high?

3. The rubber tree grows until its trunk has a circumference (distance around) of about 10 feet. Show with a string how large the trunk of such a tree is. Can you find a tree where you live whose trunk is as large as this? Name trees that have smaller trunks.

4. There are large rubber plantations in Java containing as many as 75,000 acres. They average about 125 trees to the acre. How many trees are there on such a plantation?

5. Trees are not tapped until they are 5 years old. The method of tapping is shown in the picture. Can you explain it? The average yield of a tree is about 6 pounds of latex for the entire year. How much is this a month?

6. How much latex is produced a year on a field an acre in size which has 125 trees?

7. One year the United States imported 1,045,380,000 pounds of rubber. Allowing 6 pounds as the amount produced by one tree, how many rubber trees did it take to produce the rubber we imported? From what places do we import rubber?

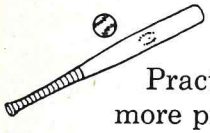
8. Years ago rubber cost as much as $3.06 a pound. In a recent year the price was about $.20 a pound. About how many times as high as the more recent price is the price $3.06? How does the price of rubber affect the price of automobile and bicycle tires?

9. At 20 cents a pound find the cost of the rubber we imported, given in problem 7.

*10. What are some of the important industries of our country that use a great deal of rubber? Look up the story of Goodyear and the vulcanizing of rubber. What is "synthetic rubber"? Why cannot we raise rubber in this country? What is guayule? Where is it grown?

HOW WELL DO YOU REMEMBER?

1. What is meant by place value?
2. Tell the value of each figure in the number 3,978.164.
3. Write as decimals: $3\frac{7}{10}$; $4\frac{19}{100}$; $\frac{275}{1000}$.
4. Which is more, .1 or .08? Prove your answer.
5. How should decimals be placed when they are to be added or subtracted?
6. State a rule for multiplying any whole number by 10 or by 100.
7. Show that 500,000 equals $\frac{1}{2}$ million.
8. Show that $2\frac{1}{2}$ million equals 2,500,000.
9. What must you know before you can find the area of the floor of a room? How do you then find its area?
10. Name five units for measuring area. Name something that has an area about equal to each of these units.



LET'S PRACTICE

Practice one set of these examples at a time. If you need more practice, repeat a set several times. Keep a record of your scores in each trial so that you can see how your work improves.

Set I

1. $\begin{array}{r} 719 \\ 5876 \\ 38 \\ 962 \\ 7694 \\ \underline{3623} \end{array}$

2. $\begin{array}{r} 12935 \\ \underline{-9876} \end{array}$

3. $\begin{array}{r} 683 \\ \underline{\times 29} \end{array}$

4. $\begin{array}{r} 9\frac{1}{2} \\ \underline{+6\frac{1}{2}} \end{array}$

5. $\begin{array}{r} 7 \\ \underline{-2\frac{1}{4}} \end{array}$

6. $\begin{array}{r} 98.7 \\ \underline{+25.4} \end{array}$

7. $53\overline{)13568}$

8. $\begin{array}{r} 685 \\ \underline{\times 460} \end{array}$

9. $94\overline{)38164}$

10. $\begin{array}{r} 35.24 \\ \underline{-9.64} \end{array}$

Set II

1. $\begin{array}{r} 2.07 \\ .87 \\ 52.14 \\ 3.65 \\ 41.44 \\ \underline{46.33} \end{array}$

2. $\begin{array}{r} 15.840 \\ \underline{-7.963} \end{array}$

3. $\begin{array}{r} 479 \\ \underline{\times 85} \end{array}$

4. $\begin{array}{r} 7\frac{1}{4} \\ \underline{+8\frac{1}{4}} \end{array}$

5. $\begin{array}{r} 8\frac{3}{4} \\ \underline{-3\frac{1}{4}} \end{array}$

6. $\begin{array}{r} 8.753 \\ \underline{+2.953} \end{array}$

7. $45\overline{)15750}$

8. $\begin{array}{r} \$9.76 \\ \underline{\times 317} \end{array}$

9. $82\overline{)4264}$

10. $\frac{1}{2}$ of 56 =

USING THE VOCABULARY OF ARITHMETIC

Write sentences containing the words below. Be ready to read these sentences to the class.

sale	value	amount	measurement	size
weight	account	rectangle	square inch	capacity
statement	increase	area	estimate	P.M.
perimeter	ounce	charge	dimensions	contents

MEASURING GROWTH IN PROBLEM SOLVING

1. At a sale George bought a $25 bicycle for $18.75. What was the reduction?

2. Patty caught 6 fish. Their total weight was 10 pounds. What was their average weight?

3. Each day Arthur spends 23 cents for lunch and 15 cents for carfare. How much does he spend for lunch and carfare in 20 days?

4. On a 25-acre field a farmer raised 2,575 bushels of potatoes. How many bushels did he raise on an acre?

5. At a $\frac{1}{4}$-off sale June bought a $5 dress. How much was the reduction?

6. On three tests in spelling, Ann's scores were 80, 100, and 90. What was her average score?

7. Where Peter lives the normal rainfall in January is 2.70 inches and in February 3.12 inches. One year 4.07 inches of rain fell during these two months. How much less than the normal amount was this?

8. Jack lives on a large farm that is $\frac{7}{8}$ mile long and $\frac{5}{8}$ mile wide. What is the perimeter of the farm?

9. Which has the greater area, a yard that is 25 feet wide and 128 feet deep, or a yard that is 28 feet wide and 120 feet deep? How much greater?

10. These supplies were bought for a party: $\frac{1}{2}$ pound of nuts at 60 cents a pound; 4 dozen cookies at 15 cents a dozen; 10 quarts of milk at 11 cents a quart; 24 oranges at 25 cents a dozen. How much did the supplies cost?

What Your Score Means

Unsatisfactory					Fair		Good		Excellent	
0	1	2	3	4	5	6	7	8	9	10

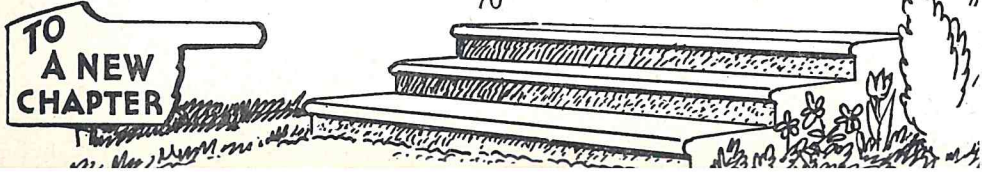
UP THE STEPS TO A NEW CHAPTER

This test will help you to find out how well you know the arithmetic you have studied. In copying the numbers be sure to leave enough space for your work.

1. Subtract \$485.36 from \$900. (9)
2. How much is $\frac{1}{8}$ of 992? (24)
3. Divide 3484 by 52. (17)
4. Divide 2361 by 47. Check your answer. (19)
5. Divide 59840 by 85. Check your answer. (19)
6. Find the sum of $8\frac{5}{8}$, $9\frac{7}{8}$, and $6\frac{3}{8}$. (26)
7. Subtract $6\frac{3}{8}$ from 12. Check by addition. (28)
8. Subtract $8\frac{3}{4}$ from $11\frac{1}{4}$. (29)
9. How much do 400 chairs cost at \$3.80 each? (57)
10. Find the product of 209 and 608. (59)
11. Multiply \$3.75 by 420. (59)
12. Express as fractions: .3, 10.5, .167. (38)
13. Express as decimals: $3\frac{7}{10}$, $9\frac{25}{100}$, $16\frac{7}{1000}$. (38)
14. Add 7.4 and 6.3. Check your answer by changing the decimals to fractions and then adding. (41)
15. Find the sum of .34, .20, and .43. (41)
16. Which is most, .1, .01, or .001? (43)
17. Subtract 48.56 from 87.31. Check by addition. (48)
18. Subtract .375 from .420. (49)
19. Which is least, .28, 1.4, .248, .182, or .95? (49)
20. At \$.25 each how many tickets can you buy for \$7.50? (54)

After your paper has been marked, correct at once any errors you may have made. Turn for help to the pages given at the right of the test.

Be sure that you know how to work every example in the test before you go on to the next chapter.



CHAPTER III

A GROCER MUST SELL FOR MORE THAN HE PAYS

1. Mr. Brown, our grocer, bought 20 dozen eggs for $5.20. He plans to sell them at 3 cents a dozen more than he paid for them. How much will the selling price a dozen be?

2. He bought 25 bushels of potatoes at 48 cents a bushel and sold them for 60 cents a bushel. How much more did he receive for all of the potatoes than he paid for them?

3. He paid $2.40 for a crate containing 24 boxes of strawberries. How much was that a box?

4. He sold 20 boxes at 12 cents each. The others he sold that evening for 8 cents a box because they were spoiling. How much more than he paid for the whole crate of berries did he receive for them?

*5. Why must the owner of a grocery store sell things for more than he pays for them? Name some of the expenses of operating a grocery store.

READINESS TEST FOR MORE DIFFICULT DIVISION

I. How well can you divide? Copy and work these examples.

1. $483 \div 23 =$	4. $2279 \div 43 =$	7. $3840 \div 96 =$
2. $1134 \div 21 =$	5. $2485 \div 56 =$	8. $657 \div 32 =$
3. $3445 \div 65 =$	6. $7921 \div 84 =$	9. $7437 \div 37 =$

II. Can you multiply and subtract correctly? Complete these examples. The quotients are correct.

8	7	6	7
1. $59\overline{)495}$	3. $27\overline{)193}$	5. $87\overline{)540}$	7. $46\overline{)330}$
9	8	9	4
2. $78\overline{)714}$	4. $96\overline{)821}$	6. $69\overline{)644}$	8. $36\overline{)149}$

III. On your paper write the part that is more. Do not write out the work. Write only your answer on your paper.

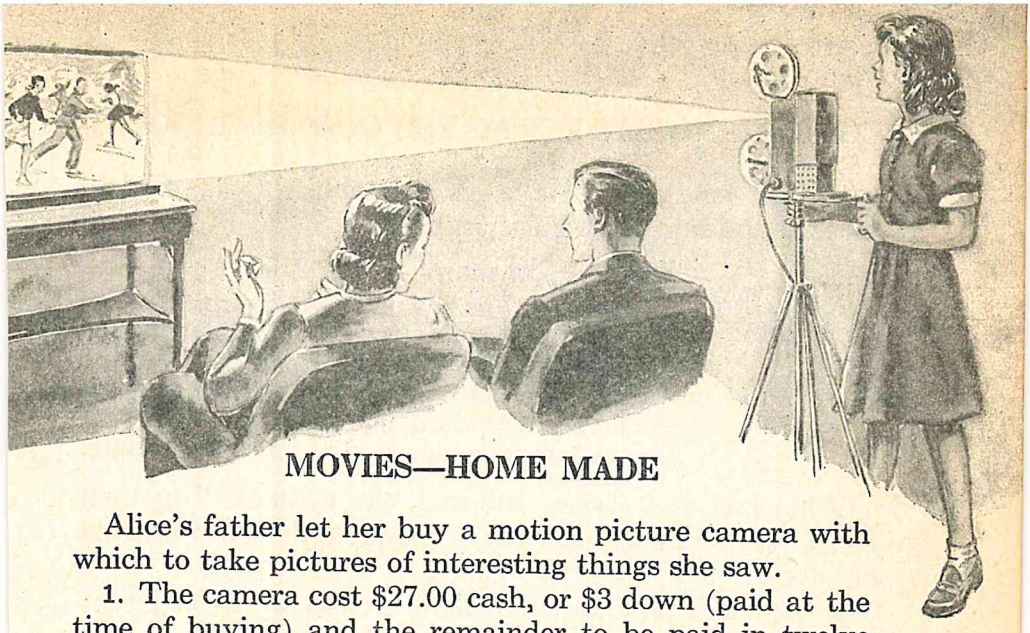
1. 4×65, or 280	3. 9×18, or 157	5. 6×87, or 523
2. 7×98, or 675	4. 8×59, or 491	6. 5×78, or 382

IV. Which of these quotients are correct? Which are not correct? Be ready to tell why.

5	4	5	7
1. $75\overline{)358}$	3. $89\overline{)337}$	5. $67\overline{)387}$	7. $36\overline{)237}$
375	356	335	252
9	6	8	6
2. $96\overline{)943}$	4. $78\overline{)448}$	6. $38\overline{)267}$	8. $28\overline{)180}$
864	468	304	168

V. In which of these quotients are the correct first figures given? You are to do enough work either in your mind or on your paper to find out.

8	8	4
1. $46\overline{)369}$	3. $56\overline{)457}$	5. $27\overline{)128}$
6	7	6
2. $19\overline{)100}$	4. $69\overline{)528}$	6. $88\overline{)557}$



MOVIES—HOME MADE

Alice's father let her buy a motion picture camera with which to take pictures of interesting things she saw.

1. The camera cost $27.00 cash, or $3 down (paid at the time of buying) and the remainder to be paid in twelve equal monthly installments. How much was each of the twelve monthly payments?

2. Films were sold in 50-foot and 100-foot rolls. How many 50-foot rolls were needed for 500 feet of film? How many 100-foot rolls?

3. The cost of ordinary film was $2.47 for a 50-foot roll, or $4.05 for a 100-foot roll. How much would be saved by buying 500 feet of film in 100-foot rolls instead of in 50-foot rolls?

4. Film for taking colored pictures cost $4.28 a 50-foot roll or $8.10 a 100-foot roll. How much more than 100 feet of ordinary film did a 100-foot roll of colored film cost?

5. How much would be saved by buying 500 feet of colored film in 100-foot rolls instead of in 50-foot rolls?

6. It takes about 5 minutes to run a 100-foot film. How many feet of film are needed for a show $\frac{1}{2}$ hour long?

*7. How many feet of film does Alice need to show pictures of a play that lasts 10 minutes?

CORRECTING THE ESTIMATED QUOTIENT FIGURE

1. How long will it take an automobile to travel 210 miles at the rate of 35 miles an hour?

A.
$$35\overline{)210}\quad 7,\ 245$$

B.
$$35\overline{)210}\quad 6,\ 210$$

THINK: How many 35's in 210?

Try $3\overline{)21}$ or 7 as the quotient figure. (See **A.**) $7 \times 35 = 245$. You cannot subtract 245 from 210. Try 6, which is 1 less than 7, as the quotient. (See **B.**) $6 \times 35 = 210$. Therefore 6 is the correct quotient figure.

The automobile can go 210 miles in 6 hours.

Whenever you cannot subtract, the estimated quotient figure is too large. You must try a quotient figure at least one less.

2. Which of the quotients below are too large? Tell why.

a. $26\overline{)48}$, 52 *b.* $37\overline{)92}$, 111 *c.* $35\overline{)128}$, 140 *d.* $64\overline{)362}$, 320

3. What should the quotient figure be in example *a*? in example *b*? in example *c*? in example *d*?

4. How many 35's are there in 126?

$$35\overline{)126}\quad 3\text{ r}21,\ 105,\ 21$$

Try $3\overline{)12}$, or 4, as the quotient figure.

You can see at once that 4×35 is more than 126, because 4×30 is 120 and 4×5 is more than the 6 of 126. So make the quotient 1 less than 4.

Is 3 the correct quotient?

5. Which of the quotients below are correct?

a. $24\overline{)162}$ *b.* $28\overline{)64}$ *c.* $76\overline{)425}$ *d.* $31\overline{)157}$

6. What should the **true** quotients be in each example?

Be sure that the remainder is always less than the number by which you are dividing.

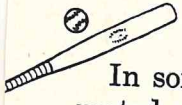
PRACTICE IN FINDING QUOTIENTS

Find the quotients:

	a	*b*	*c*	*d*	*e*
1.	$23\overline{)61}$	$32\overline{)94}$	$44\overline{)160}$	$93\overline{)274}$	$24\overline{)87}$
2.	$67\overline{)245}$	$85\overline{)249}$	$57\overline{)304}$	$78\overline{)496}$	$65\overline{)429}$
3.	$96\overline{)810}$	$14\overline{)31}$	$64\overline{)487}$	$88\overline{)569}$	$74\overline{)358}$
4.	$57\overline{)256}$	$48\overline{)125}$	$28\overline{)84}$	$36\overline{)219}$	$41\overline{)162}$

PROBLEMS TO SOLVE

1. At 25 cents each how many tickets can you buy for 85 cents? How many cents will be left?
2. How many boxes each containing a dozen eggs can be filled with 300 eggs?
3. At $1.45 each how much do 36 geography books cost?
4. In a book Jack is reading he found a page which had 31 lines and 310 words. How many words were there on the average to a line?
5. A farmer sold 35 pounds of butter for $10.85. How much did he receive a pound for the butter?



LET'S PRACTICE

In some of these examples you must correct your estimated quotient; in others your estimated quotient will be correct.

	a	*b*	*c*	*d*	*e*
1.	$21\overline{)86}$	$91\overline{)724}$	$46\overline{)247}$	$56\overline{)340}$	$39\overline{)61}$
2.	$28\overline{)67}$	$85\overline{)401}$	$35\overline{)147}$	$72\overline{)496}$	$13\overline{)39}$
3.	$81\overline{)243}$	$49\overline{)248}$	$66\overline{)543}$	$98\overline{)624}$	$58\overline{)247}$
4.	$89\overline{)647}$	$77\overline{)483}$	$94\overline{)543}$	$71\overline{)569}$	$99\overline{)816}$

ESTIMATING MORE DIFFICULT QUOTIENTS

1. How many 25-pound sacks can you fill with 150 pounds of sugar?

A.
$$25\overline{)150}\quad 7,\ \underline{175}$$

Try $2\overline{)15}$, or 7, as the first quotient figure. 7×25 is 175, which is more than 150. (See A.)

B.
$$25\overline{)150}\quad 6,\ \underline{150}$$

Try 6 as a quotient figure. $6 \times 25 = 150$. (See B.) Therefore 6 is the correct quotient figure.

You can fill 6 25-pound sacks.

2. Which of these quotients are too large? Tell why.

a. $26\overline{)50}$, $\underline{52}$ (2) *b.* $37\overline{)71}$, $\underline{74}$ (2) *c.* $35\overline{)134}$, $\underline{140}$ (4) *d.* $66\overline{)332}$, $\underline{330}$ (5)

3. Which of these quotients are correct?

a. $25\overline{)179}$ (8) *b.* $27\overline{)53}$ (2) *c.* $76\overline{)443}$ (6) *d.* $36\overline{)191}$ (5)

Find these products:

	a	*b*	*c*	*d*	*e*
4.	$75 \times 8 =$	$47 \times 6 =$	$38 \times 7 =$	$56 \times 8 =$	$77 \times 3 =$
5.	$22 \times 6 =$	$49 \times 7 =$	$84 \times 3 =$	$94 \times 4 =$	$58 \times 4 =$
6.	$86 \times 6 =$	$59 \times 4 =$	$97 \times 3 =$	$87 \times 6 =$	$62 \times 7 =$

Divide and check your work:

	a	*b*	*c*	*d*	*e*
7.	$22\overline{)131}$	$75\overline{)652}$	$59\overline{)161}$	$32\overline{)269}$	$68\overline{)396}$
8.	$97\overline{)372}$	$84\overline{)331}$	$58\overline{)437}$	$47\overline{)302}$	$23\overline{)112}$
9.	$77\overline{)293}$	$46\overline{)87}$	$86\overline{)586}$	$39\overline{)176}$	$53\overline{)209}$
10.	$87\overline{)600}$	$56\overline{)460}$	$94\overline{)458}$	$49\overline{)379}$	$62\overline{)485}$

WHEN THE QUOTIENT FIGURE SEEMS MORE THAN 9

1. At the rate of 34 miles an hour, how long does it take a ship to go 306 miles?

$$\begin{array}{r} 9 \\ 34\overline{)306} \\ \underline{306} \end{array}$$

In this example you can see that 30 will not contain 34. You must find how many 34's there are in 306. So try $3\overline{)30}$. This gives 10. If 10 were the correct quotient, the number divided would be at least 10×34, or 340.

This is more than 306. When the quotient figure seems to be more than 9, try 9. Is 9 correct in this example?

The ship would go 306 miles in 9 hours.

2. Are these quotient figures correct?

$$\begin{array}{llll} a.\ \begin{array}{r} 9 \\ 43\overline{)407} \end{array} & b.\ \begin{array}{r} 10 \\ 67\overline{)670} \end{array} & c.\ \begin{array}{r} 9 \\ 95\overline{)936} \end{array} & d.\ \begin{array}{r} 10 \\ 24\overline{)256} \end{array} \end{array}$$

When the quotient figure seems to be more than 9, try 9 as the quotient figure. If 10 were correct, the number divided would be at least 10 times the divisor.

Find the products:

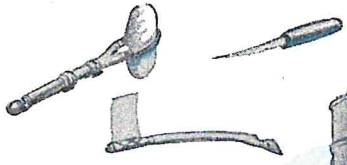
	a	*b*	*c*	*d*	*e*
3.	$86 \times 6 =$	$97 \times 6 =$	$39 \times 9 =$	$85 \times 9 =$	$37 \times 9 =$
4.	$59 \times 9 =$	$69 \times 9 =$	$97 \times 6 =$	$68 \times 7 =$	$95 \times 8 =$
5.	$45 \times 9 =$	$29 \times 9 =$	$73 \times 9 =$	$82 \times 9 =$	$56 \times 9 =$
6.	$34 \times 8 =$	$98 \times 5 =$	$79 \times 8 =$	$33 \times 9 =$	$48 \times 5 =$

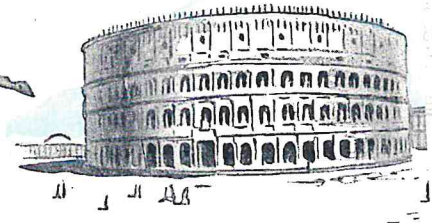
Divide and check your work:

7.	$29\overline{)276}$	$33\overline{)308}$	$45\overline{)428}$	$69\overline{)642}$	$55\overline{)529}$
8.	$82\overline{)807}$	$95\overline{)836}$	$37\overline{)348}$	$49\overline{)462}$	$78\overline{)716}$
9.	$34\overline{)315}$	$59\overline{)546}$	$27\overline{)92}$	$68\overline{)517}$	$97\overline{)654}$
10.	$85\overline{)835}$	$79\overline{)667}$	$73\overline{)716}$	$48\overline{)253}$	$89\overline{)845}$
11.	$98\overline{)576}$	$39\overline{)358}$	$86\overline{)519}$	$56\overline{)523}$	$99\overline{)471}$

A TIME LINE

2000 B.C. — Knives, hammers, and hand looms used before 2000 B.C.



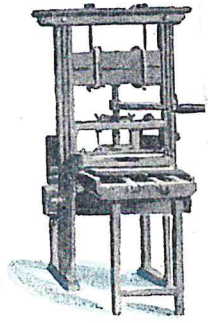


1000 B.C.

753 B.C. — Rome founded.

334 B.C. — First university built at Alexandria, Egypt.

1 A.D. — Birth of Christ. Anno Domini.



476 A.D. — End of the Roman Empire.

1000 A.D. — The first clock with wheels used.

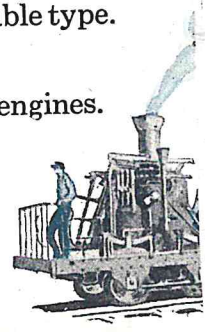
1450 A.D. — Invention of printing press with movable type.

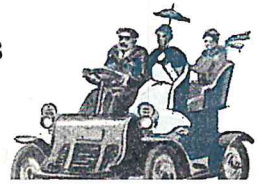
1492 A.D. — Columbus discovered America.

1750 A.D. — First use of machines run by steam engines.

1900 A.D. — Automobiles first used.

194– — Today.





A TIME LINE

The **time line** on page 78 helps us to understand the length of time between some important events in the history of the world.

Our system of numbering years starts with the birth of Christ. If an event took place before the birth of Christ, the year is marked **B.C.** (Before Christ). If the event took place after the birth of Christ, the year is marked **A.D.** (Anno Domini, words that mean "In the year of our Lord").

1. According to the time line, when was Rome founded?
2. When did Columbus discover America?
3. How many years was it between the founding of Rome and the discovery of America by Columbus?
4. When was the first clock with wheels used?
5. How long after the first clock with wheels was used were the first machines run by steam engines used? What kinds of tools did people use before they began to use machines?
6. Name some tools that were invented in the last two centuries, shown on the time line. Can you name others?
7. The Declaration of Independence was signed July 4, 1776. Point to the place on the time line that will show when this event took place.
8. How many years was it from the founding of Rome to the end of the Roman Empire of the West? Has our country existed that long as an independent nation?

*9. We know that people lived on this earth many thousands of years before Christ. What can you say about the length of time in the history of the human race during which we have used machinery? How has machinery changed our ways of living?

*10. Why are the ends of the time line left open?

SAVING TIME IN DIVISION

Agnes has found some ways to save time in working division examples. Study the work below.

1.
$$93\overline{)453}\quad 4,\ 372,\ 81$$

In working this example Agnes sees at once that 5 is not the correct quotient figure because 5×93 will be more than 453. She thinks: 5×90 is 450 and 5×3 is 15. Their sum will be 465, which is more than 453. So she writes 4 in the quotient.

2.
$$58\overline{)285}\quad 4,\ 232,\ 53$$

She is not sure whether the quotient figure in example 2 is 5 or 4. So she multiplies 58 by 5 in her mind without writing out the work. The product she gets is 290, which is more than 285. So she knows that 5 is too large.

You can save much time in working division examples by multiplying in your mind (mentally) before deciding what the correct quotient figure will be.

Without using your pencil, estimate which is greater:

	a	*b*	*c*
3.	3×64, or 186	6×47, or 297	2×75, or 162
4.	7×48, or 297	2×84, or 165	9×47, or 401
5.	8×96, or 745	3×75, or 240	4×58, or 242
6.	6×95, or 583	5×86, or 427	6×86, or 530
7.	2×96, or 186	9×85, or 780	3×89, or 273
8.	9×69, or 604	4×69, or 271	7×59, or 358
9.	4×74, or 302	8×78, or 642	5×79, or 398

Tell what the quotient figure in each example below is by multiplying mentally:

	a	*b*	*c*	*d*	*e*
10.	$83\overline{)648}$	$24\overline{)169}$	$45\overline{)167}$	$56\overline{)318}$	$32\overline{)129}$
11.	$75\overline{)438}$	$67\overline{)385}$	$96\overline{)473}$	$53\overline{)285}$	$86\overline{)341}$

PRACTICE IN NAMING QUOTIENT FIGURES

Set I

	a	*b*	*c*	*d*	*e*
1.	97)568	21)81	34)200	36)63	65)600
2.	86)339	95)638	54)524	49)124	93)813
3.	77)425	67)251	32)156	95)918	53)513
4.	46)427	87)246	78)280	67)628	46)130
5.	65)385	93)453	34)307	55)262	32)283
6.	55)423	54)161	21)187	86)817	24)192

Set II

1.	69)146	26)76	47)462	36)189	24)95
2.	37)71	49)124	32)185	78)462	21)138
3.	87)731	37)264	41)143	53)264	97)837
4.	77)304	26)249	74)336	96)903	48)237
5.	53)274	49)264	45)319	64)619	56)294
6.	79)290	69)368	56)140	49)270	54)124

Set III

1.	40)182	68)395	22)131	27)252	85)335
2.	76)354	61)485	44)186	43)417	75)648
3.	31)300	25)176	84)812	35)213	68)642
4.	94)465	72)283	58)531	63)342	98)369
5.	73)223	59)175	82)810	96)926	57)443
6.	89)478	88)706	99)621	38)128	79)747

FINDING AVERAGES

1. On a 58-acre field a farmer raised 2,726 bushels of corn. How many bushels an acre did he raise?

$$58\overline{)2726}$$

THINK: 2726 bu. ÷ 58 = ·?

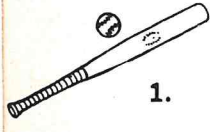
47
232 How many 58's in 272?
406 How many 58's in 406?
406 Did you have to correct each quotient figure?
The farmer raised 47 bu. an acre.

2. The total weight of the 36 children in a certain class was 3,420 pounds. How much was their average weight?

PRACTICE IN DIVISION

In some of these examples you must correct your estimates of the quotient figures.

	a	*b*	*c*	*d*
1.	$74\overline{)4483}$	$64\overline{)32437}$	$33\overline{)2945}$	$56\overline{)4238}$
2.	$26\overline{)2358}$	$93\overline{)7486}$	$53\overline{)2633}$	$87\overline{)6023}$
3.	$47\overline{)4606}$	$78\overline{)5480}$	$43\overline{)3608}$	$64\overline{)6198}$
4.	$68\overline{)7354}$	$34\overline{)2007}$	$96\overline{)9024}$	$79\overline{)2909}$



LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	$3\frac{1}{2}$ $+2\frac{1}{2}$	675 $\times 500$	$8\frac{1}{4}$ $-5\frac{1}{4}$	$4\frac{1}{4}$ $+5\frac{1}{4}$	7.85 $+9.64$
2.	29.875 -6.492	$6\frac{3}{4}$ $+7\frac{3}{4}$	968 $\times 497$	$6\frac{7}{8}$ $-4\frac{1}{8}$	$43\overline{)3608}$
3.	738 $\times 806$	$87\overline{)8352}$	5 $-2\frac{1}{2}$	$20\overline{)817}$	$9\frac{1}{4}$ $-6\frac{3}{4}$

4. Find the sum of 87.4, 96.8, 85.2, and 1.9.

PRACTICING MULTIPLICATION AND SUBTRACTION IN DIVISION

The correct answer is given for each of the following examples. You are to complete the solution. If the final remainder in your solution is not the same as the one given, you have made an error in either multiplication or subtraction, or in both. Be sure to copy the numbers correctly.

	a	*b*	*c*
1.	506 r53 64)32437	60 r43 74)4483	39 r43 86)3397
2.	36 r21 49)1785	65 r10 35)2285	29 r38 54)1604
3.	48 r35 96)4643	45 r13 58)2623	92 r38 46)4270
4.	73 r13 23)1692	37 r24 43)1615	25 r19 49)1244
5.	108 r10 68)7354	83 r39 43)3608	59 r22 65)3857
6.	70 r20 78)5480	69 r20 87)6023	55 r19 77)4254
7.	90 r18 26)2358	80 r46 93)7486	48 r69 93)4533
8.	75 r38 56)4238	89 r8 33)2945	94 r6 96)9030

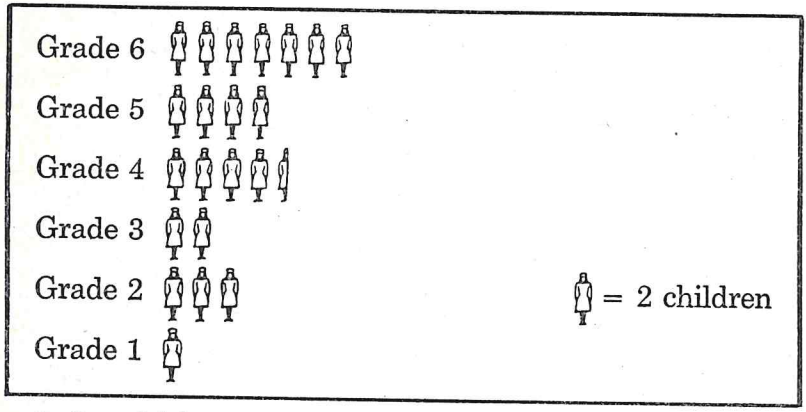
9. In how many of these examples did you make an error in subtraction? in multiplication?

WHICH IS MORE?

	a	*b*	*c*
1.	5 × 38, or 180	4 × 59, or 231	9 × 49, or 437
2.	7 × 48, or 315	9 × 28, or 230	8 × 68, or 523
3.	8 × 59, or 482	7 × 97, or 852	6 × 59, or 374

JOINING THE JUNIOR RED CROSS

This picture graph shows the number of children in the Bancroft School who have joined the Junior Red Cross.



1. In which grade did the largest number of children join the Junior Red Cross? How can you tell? Each picture stands for two children.
2. How many joined in grade 6? in grade 5?
3. What does the half child after grade 4 stand for? How many children in grade 4 joined the Junior Red Cross?
4. How many children in all grades joined the Junior Red Cross?

*5. Make a drawing like this one to show how many children in your school belong to the Junior Red Cross. What does the Junior Red Cross do?

WORKING FOR THE JUNIOR RED CROSS

WHAT IS WRONG?

Study the work and the check in each of these examples to find the errors. Then work and check the example.

1. The work

$$\begin{array}{r} 36\text{ r}1 \\ 24\overline{)865} \\ 72 \\ \hline 145 \\ 144 \\ \hline 1 \end{array}$$

The check

$$\begin{array}{r} 36 \\ \times 24 \\ \hline 144 \\ 620 \\ \hline 864 \\ +1 \\ \hline 865 \end{array}$$

2. The work

$$\begin{array}{r} 26\text{ r}18 \\ 37\overline{)970} \\ 74 \\ \hline 230 \\ 222 \\ \hline 18 \end{array}$$

The check

$$\begin{array}{r} 26 \\ \times 37 \\ \hline 172 \\ 780 \\ \hline 952 \\ +18 \\ \hline 970 \end{array}$$

3. The work

$$\begin{array}{r} 24\text{ r}3 \\ 48\overline{)9795} \\ 96 \\ \hline 195 \\ 192 \\ \hline 3 \end{array}$$

The check

$$\begin{array}{r} 24 \\ \times 48 \\ \hline 192 \\ 96 \\ \hline 1252 \end{array}$$

4. The work

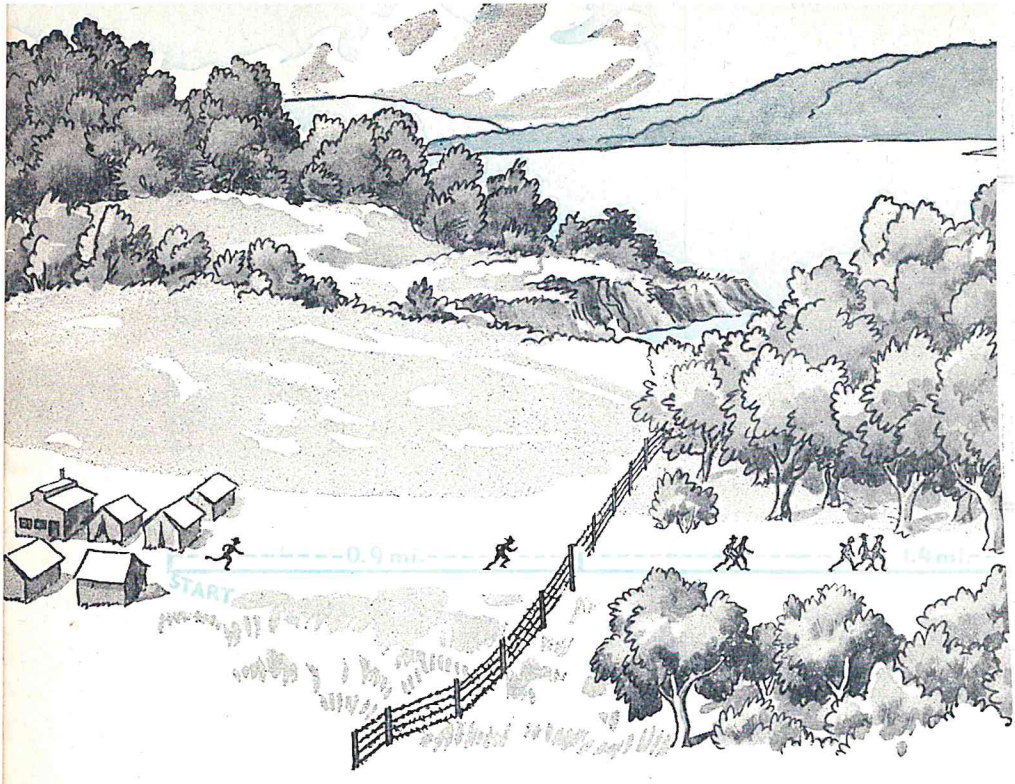
$$\begin{array}{r} 6\text{ r}23 \\ 97\overline{)5843} \\ 582 \\ \hline 23 \end{array}$$

The check

$$\begin{array}{r} 97 \\ \times 6 \\ \hline 582 \\ +23 \\ \hline 5843 \end{array}$$

PRACTICE IN DIVISION

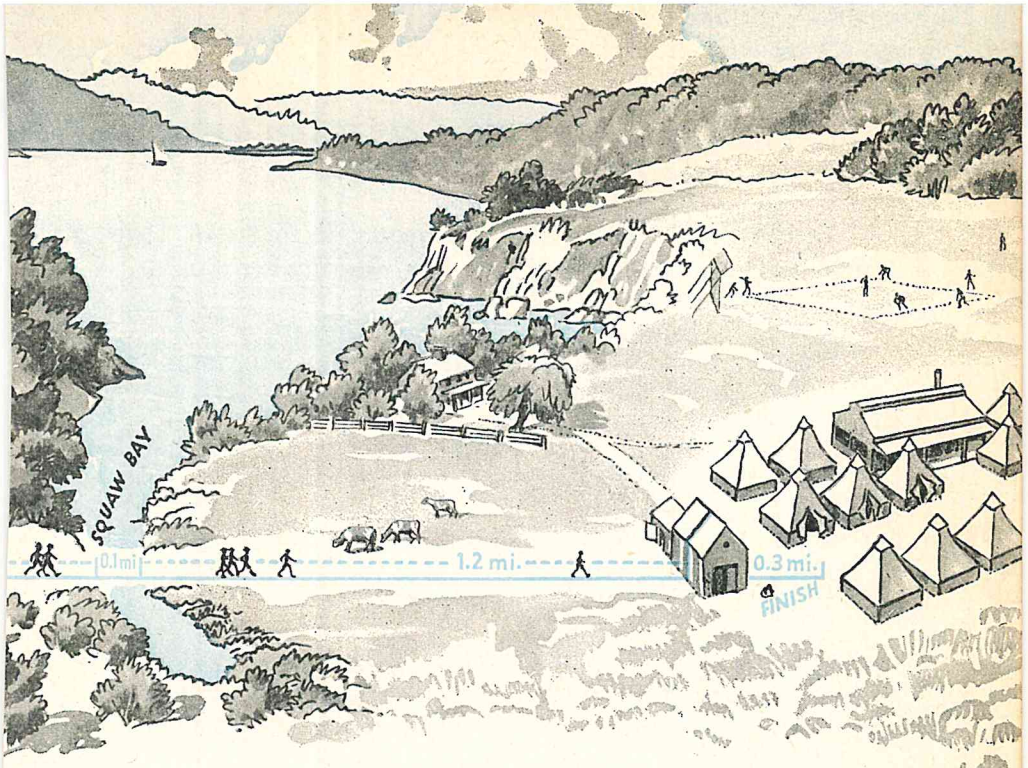
	a	*b*	*c*	*d*
1.	$83\overline{)1545}$	$86\overline{)8040}$	$21\overline{)817}$	$55\overline{)2623}$
2.	$65\overline{)3857}$	$77\overline{)4254}$	$93\overline{)4533}$	$46\overline{)4270}$
3.	$25\overline{)2327}$	$32\overline{)1563}$	$86\overline{)3397}$	$68\overline{)6596}$
4.	$73\overline{)7026}$	$54\overline{)1604}$	$94\overline{)9065}$	$49\overline{)1244}$
5.	$28\overline{)644}$	$67\overline{)4835}$	$83\overline{)2497}$	$95\overline{)7220}$
6.	$57\overline{)2584}$	$38\overline{)3434}$	$53\overline{)5459}$	$88\overline{)8272}$
7.	$48\overline{)1642}$	$79\overline{)6345}$	$43\overline{)1615}$	$23\overline{)1692}$
8.	$58\overline{)2623}$	$49\overline{)1785}$	$96\overline{)4643}$	$35\overline{)2285}$



A BEE-LINE HIKE BY BOY SCOUTS

On a bee-line hike you are not allowed to go around any obstacle. You must go over it or through it. The map above shows a bee-line hike one troop of Boy Scouts took.

1. How far is it from the start to Squaw Bay?
2. How far is it from Squaw Bay to the finish?
3. How far is it from the start to the finish?
4. The barbed wire fence was 6 feet high. The shortest boy in the group was $4\frac{1}{4}$ feet tall. How much higher was the top of the fence than the shortest boy?
5. Which is nearer Squaw Bay, the barbed wire fence or the barn? How much nearer?

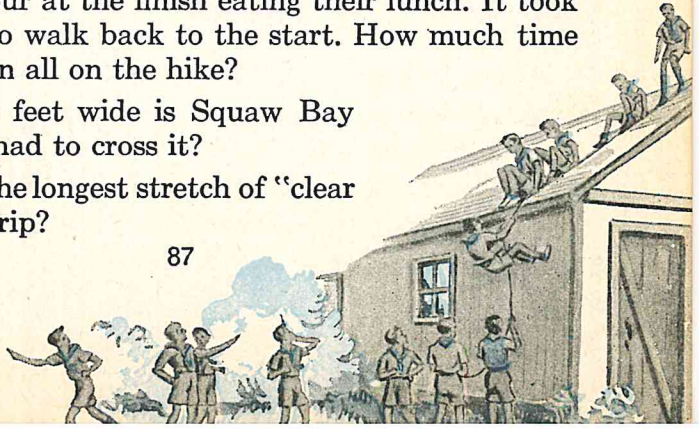


6. The boys had to climb over the barn. It is 10 feet from the ground to the edge of the roof and it is 8 feet from the edge of the roof to the peak. How long a rope would it take to reach from the ground on one side of the barn to the ground on the other side of the barn?

7. It took the boys $3\frac{1}{4}$ hours to make the bee-line hike. They spent $\frac{3}{4}$ hour at the finish eating their lunch. It took them $1\frac{3}{4}$ hours to walk back to the start. How much time did they spend in all on the hike?

*8. How many feet wide is Squaw Bay where the boys had to cross it?

*9. What was the longest stretch of "clear hiking" on the trip?



TRUE QUOTIENT TWO LESS THAN THE ESTIMATED QUOTIENT

1. In the Harper School 196 children ride in buses. How many buses are needed if 28 children ride in each bus?

A.
$$\begin{array}{r} 9 \\ 28\overline{)196} \\ \underline{252} \end{array}$$

THINK: There are 9 twos in 19.

Study the work in A at the left. You can see that 9 is too large. So try a quotient figure **one less.**

B.
$$\begin{array}{r} 8 \\ 28\overline{)196} \\ \underline{224} \end{array}$$

Try 8 as the quotient. Study the work in B at the left. How can you tell that 8 is also too large?

C.
$$\begin{array}{r} 7 \\ 28\overline{)196} \\ \underline{196} \end{array}$$

Now try 7 in the quotient. Is 7 the correct quotient figure?

Seven buses are needed.

When you cannot subtract, try the next smallest quotient figure, one less than the one you used. Erase the number you cannot subtract and also the incorrect quotient.

2. Which of the following quotients are too large?

a. $\begin{array}{r} 8 \\ 27\overline{)185} \end{array}$ *b.* $\begin{array}{r} 3 \\ 38\overline{)151} \end{array}$ *c.* $\begin{array}{r} 9 \\ 26\overline{)209} \end{array}$ *d.* $\begin{array}{r} 6 \\ 49\overline{)330} \end{array}$

3. Find the correct quotients for the examples in 2.

PRACTICE IN DIVISION

	a	*b*	*c*	*d*
1.	$28\overline{)172}$	$49\overline{)339}$	$38\overline{)153}$	$29\overline{)237}$
2.	$27\overline{)243}$	$39\overline{)153}$	$26\overline{)233}$	$48\overline{)374}$
3.	$57\overline{)454}$	$59\overline{)462}$	$25\overline{)190}$	$37\overline{)240}$
4.	$25\overline{)1900}$	$37\overline{)2405}$	$26\overline{)2054}$	$59\overline{)50386}$
5.	$26\overline{)2337}$	$42\overline{)3376}$	$76\overline{)61239}$	$68\overline{)60996}$

TRUE QUOTIENT THREE LESS THAN ESTIMATED QUOTIENT

You have learned to work division examples in which the correct quotient is one or two less than the first estimated quotient. Sometimes the correct quotient will be **three less** than your first estimate. The example below is of this kind.

```
   6 r15
28)183
  168
   15
```

You first think: $2\overline{)18}$ is 9. You can see immediately that 9 is too large. So you try 8.
$8 \times 28 = 224$. So 8 is also too large. Try 7.
$7 \times 28 = 196$. So 7 is too large. Try 6.
$6 \times 28 = 168$. 6 is the correct quotient.

Find the correct quotient figures:

1. $29\overline{)187}$ 2. $39\overline{)272}$ 3. $28\overline{)165}$ 4. $29\overline{)200}$ 5. $27\overline{)160}$

In these examples you may have to correct the estimated quotient figures one, two, or even three times.

PRACTICE IN DIVISION

	a	*b*	*c*	*d*
1.	$39\overline{)2728}$	$59\overline{)4232}$	$29\overline{)1876}$	$47\overline{)3155}$
2.	$83\overline{)5810}$	$29\overline{)2000}$	$68\overline{)1254}$	$27\overline{)1604}$
3.	$76\overline{)5468}$	$28\overline{)1659}$	$27\overline{)1823}$	$97\overline{)6791}$

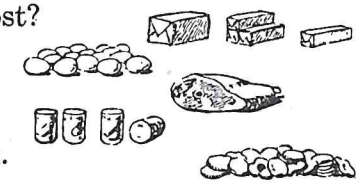
Watch the zero difficulties in the examples below.

	a	*b*	*c*	*d*
4.	$43\overline{)21672}$	$31\overline{)12462}$	$20\overline{)16120}$	$37\overline{)18796}$
5.	$97\overline{)77664}$	$58\overline{)17922}$	$95\overline{)19380}$	$87\overline{)52208}$
6.	$76\overline{)61484}$	$47\overline{)13429}$	$84\overline{)34104}$	$54\overline{)11124}$
7.	$78\overline{)46800}$	$28\overline{)25088}$	$36\overline{)18216}$	$65\overline{)32955}$

SOLVING PROBLEMS ORALLY

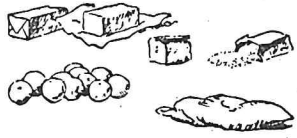
Here are problems like those you often solve at the store without writing out the work. Give the answers orally.

How much do the following cost?



1. 3 lb. of butter at 38¢ a lb.
2. 4 doz. eggs at 27¢ a doz.
3. 5 lb. meat at 37¢ a lb.
4. 6 cans of corn at 16¢ a can.
5. 10 lb. cookies at 28¢ a lb.
6. 2 loaves of bread at 12¢ a loaf and 1 lb. butter at 38¢.
7. 2 doz. oranges at 32¢ a doz. and 5 lb. of bananas at 6¢ a lb.

How much does one unit of each of these cost?

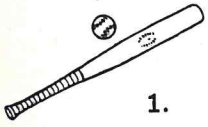


8. 4 lb. butter that cost $1.56.
9. 10 lb. sugar that cost 54¢.
10. 1 doz. oranges that cost 36¢.
11. 24 lb. of flour that cost $1.20.

Find the totals of these amounts, adding from left to right:

12. 27¢ + 3¢ + 10¢ + 10¢ + 50¢ =
13. 58¢ + 2¢ + 10¢ + 5¢ + 25¢ =
14. 3¢ + 2¢ + 10¢ + 10¢ + 25¢ =

*15. Make up a set of 20 examples like those given above.



LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	$6\frac{7}{8}$ $+8\frac{5}{8}$	9.74 −8.63	8 $-4\frac{3}{4}$	$5\frac{1}{2}$ $+9\frac{1}{2}$	685 ×209
2.	$16\frac{1}{4}$ $-8\frac{3}{4}$	$6.75 ×387	6.375 +9.625	$28\overline{)1904}$	$15\frac{7}{8}$ $-8\frac{1}{8}$
3.	675 ×600	64.3 −27.9	$8\frac{1}{4}$ $+6\frac{1}{4}$	$12\frac{3}{8}$ $-4\frac{3}{8}$	$76\overline{)61237}$

4. Add: 78.56 + 97.84 + 269.54 + 7.85.

PRACTICING MULTIPLICATION AND SUBTRACTION IN DIVISION

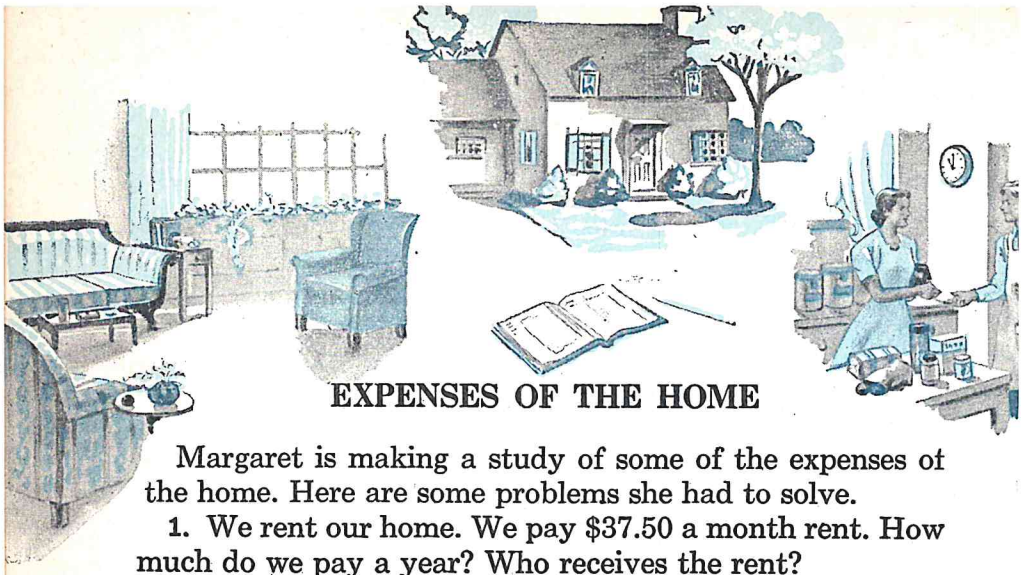
In the division examples given below, only the quotient or a part of it is given. You are to complete each example. If your answer is not the same as that given in the example, you made an error in multiplication, in subtraction, or in both. Where the whole quotient is not given, you may also have made an error in estimation.

	a	*b*	*c*
1.	80 r23 98)7863	406 r18 79)32092	70 r37 88)85397
2.	7 r30 39)3072	6 r51 88)6739	06 r12 98)69200
3.	r34 57)3682	6 r23 28)1843	r31 87)53536
4.	60 89)5340	7 r64 69)1237	4 r12 95)43047
5.	2 r31 36)14503	9 r66 82)8020	7 r18 69)50940
6.	68 r43 49)3375	3 r2 21)84065	9 r26 75)60701
7.	7 r38 59)4286	7 73)1971	6 r21 89)43275

HOW WELL CAN YOU MULTIPLY MENTALLY?

Multiply in each row by the number in heavy type.

1.	**2** ×	43	52	67	98	5. **6** ×	34	48	59	26
2.	**3** ×	27	84	59	73	6. **7** ×	47	96	23	85
3.	**4** ×	52	96	74	38	7. **8** ×	28	34	57	69
4.	**5** ×	94	87	36	25	8. **9** ×	52	37	64	89



EXPENSES OF THE HOME

Margaret is making a study of some of the expenses of the home. Here are some problems she had to solve.

1. We rent our home. We pay $37.50 a month rent. How much do we pay a year? Who receives the rent?

2. Last year we spent $78.00 for coal to heat our home. How much did we spend a month on the average? Find out how much it cost to heat your home last year.

3. For light, telephone, and gas we paid on the average $9.00 a month. How much was that a day? Count 30 days as a month. Do you have these services in your home? How much do they cost?

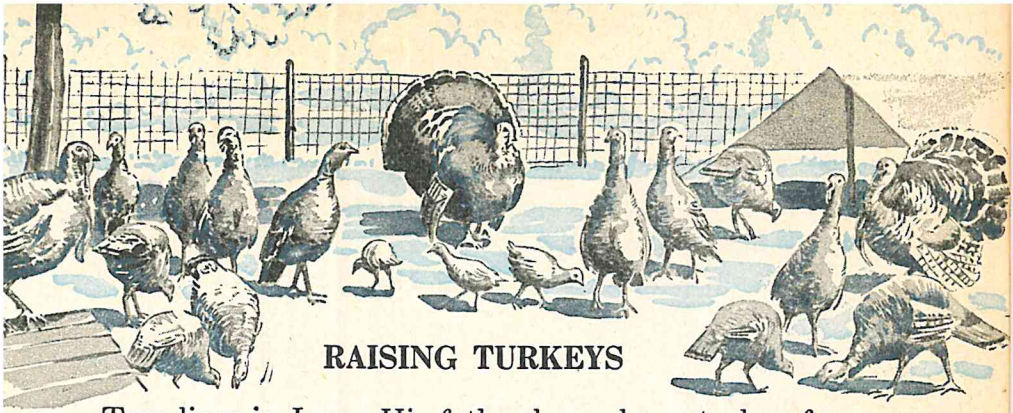
4. Margaret's mother kept an account of the money spent for food. She spent on the average $12.46 a week for food. How much was this a day? How much was this for a year? (52 wk. = 1 yr.)

*5. Make a list of the expenses of keeping up a home that are suggested by the picture above.

PRACTICE IN DIVISION

Check the first two examples in each row.

	a	*b*	*c*	*d*
1.	$27\overline{)1728}$	$39\overline{)1628}$	$48\overline{)2375}$	$67\overline{)4289}$
2.	$29\overline{)1308}$	$84\overline{)7230}$	$99\overline{)6935}$	$52\overline{)36708}$



RAISING TURKEYS

Tom lives in Iowa. His father has a large turkey farm. Here are some problems Tom made up about turkeys.

1. Turkeys grow very fast. At birth they weigh only 2 or 3 ounces. In a few months they weigh as much as 12 pounds. Last year we sold to a butcher 75 turkeys that weighed 1,050 pounds. What was their average weight?

2. We hatch the eggs in incubators. About $\frac{1}{5}$ of the eggs laid by our turkey hens do not hatch. How many eggs can we expect to hatch out of 1000 eggs?

3. Turkey hens lay about 50 eggs a year. How many eggs can we expect our 48 hens to lay in one year?

4. This year we have 670 turkeys to sell. Counting 12 pounds as their average weight, how much should we receive for the turkeys if we sell them at 24 cents a pound?

PRACTICE IN DIVISION

In some of the examples below, the quotient figure will not have to be corrected. In others it may be one less, and in others it may be two less. Do your work carefully.

	a	*b*	*c*	*d*
1.	$32\overline{)1920}$	$66\overline{)4444}$	$54\overline{)5037}$	$77\overline{)7072}$
2.	$24\overline{)2081}$	$85\overline{)4832}$	$38\overline{)2452}$	$92\overline{)9734}$
3.	$85\overline{)5960}$	$47\overline{)4183}$	$22\overline{)2044}$	$47\overline{)9353}$

MORE PRACTICE IN DIVISION

REMEMBER: When the figure you use for the quotient is too large, you always make this figure one less until the correct figure is found.

Check each example by going over the work.

	a	*b*	*c*	*d*
1.	$28\overline{)1839}$	$57\overline{)3677}$	$88\overline{)6738}$	$39\overline{)3062}$
2.	$79\overline{)32082}$	$89\overline{)5361}$	$98\overline{)7859}$	$21\overline{)63092}$

A QUICK REVIEW OF FRACTIONS AND DECIMALS

Find the sums:

	a	*b*	*c*	*d*	*e*	*f*
1.	$\frac{1}{4}$ $\frac{1}{4}$	$5\frac{1}{3}$ $6\frac{1}{3}$	3.1 2.7	$\frac{1}{3}$ $\frac{1}{3}$	$8\frac{1}{4}$ $7\frac{1}{4}$	5.8 6.9
2.	$9\frac{1}{3}$ $6\frac{2}{3}$	.87 .56	$\frac{3}{4}$ $\frac{1}{4}$	.397 .365	$7\frac{5}{6}$ $9\frac{5}{6}$	$\frac{1}{2}$ $\frac{1}{2}$
3.	2.58 7.94	$\frac{3}{4}$ $\frac{3}{4}$	$8\frac{1}{2}$ $6\frac{1}{2}$	28.1 4.3	$\frac{5}{8}$ $\frac{7}{8}$	9.784 2.697
4.	$7\frac{7}{8}$ $5\frac{7}{8}$	.6 .2	8.3 0.7	$\frac{2}{3}$ $\frac{2}{3}$	.08 .01	$6\frac{3}{10}$ $5\frac{7}{10}$

Subtract:

1.	$\frac{3}{4}$ $\frac{1}{4}$	.97 .84	1 $\frac{1}{4}$	3.8 1.9	$\frac{2}{3}$ $\frac{1}{3}$	$1\frac{1}{4}$ $\frac{3}{4}$
2.	$12\frac{7}{8}$ $5\frac{3}{8}$	$\frac{1}{2}$ $\frac{1}{2}$	12.76 8.95	$1\frac{1}{8}$ $\frac{5}{8}$	.994 .805	$3\frac{1}{4}$ $2\frac{1}{4}$
3.	1 $\frac{1}{2}$	.6 .4	$\frac{7}{8}$ $\frac{1}{8}$	18.4 14.6	$9\frac{7}{10}$ $3\frac{1}{10}$	$11\frac{2}{3}$ $8\frac{1}{3}$
4.	$\frac{4}{5}$ $\frac{1}{5}$	$15\frac{1}{4}$ $9\frac{3}{4}$	1.5 0.7	$18\frac{3}{8}$ $8\frac{7}{8}$	8.978 5.486	1 $\frac{3}{4}$

DIVIDING BY NUMBERS FROM 11 TO 19

Arthur found it quite difficult to divide by numbers from 11 to 19. So Miss Clark showed him how she had learned to work with these numbers, using the table of 16's as an example. She said, "I first made a multiplication table of 16's like the one shown at the right. Then all I had to do was to use the table to find my quotient. For example, if I wanted to find how many 16's there are in 120, I could see from the table that 120 is between 7×16 and 8×16. So I knew that the correct quotient was 7."

$1 \times 16 = 16$
$2 \times 16 = 32$
$3 \times 16 = 48$
$4 \times 16 = 64$
$5 \times 16 = 80$
$6 \times 16 = 96$
$7 \times 16 = 112$
$8 \times 16 = 128$
$9 \times 16 = 144$

1. Use the table of 16's to find the quotients for these examples.

a. $16\overline{)54}$ *b.* $16\overline{)78}$ *c.* $16\overline{)107}$ *d.* $16\overline{)123}$ *e.* $16\overline{)158}$

Practice dividing by 16, other numbers less than 160.

2. Now find the quotients for the examples below, not using the table. Which way is easier?

a. $16\overline{)44}$ *b.* $16\overline{)62}$ *c.* $16\overline{)93}$ *d.* $16\overline{)114}$ *e.* $16\overline{)142}$

Make a table of 17's and 18's like the one above for 16's. Then find the quotients of the examples below:

	a	*b*	*c*	*d*	*e*
3.	$17\overline{)43}$	$17\overline{)62}$	$17\overline{)95}$	$17\overline{)136}$	$17\overline{)158}$
4.	$18\overline{)37}$	$18\overline{)54}$	$18\overline{)97}$	$18\overline{)123}$	$18\overline{)161}$

5. Use the tables of 16, 17, and 18 to find the answers to examples on page 96 having these divisors.

*6. Arthur's father told him that he often changed 19 to 20 when dividing by 19. Use this method to see if it gives you the correct quotients in dividing these numbers by 19:

42 67 84 116 130 149 186

DIVIDING BY THE NUMBERS FROM 11 TO 19

1. Mary's mother had 80 cookies to divide among 16 children. How many should each child receive?

A. $16\overline{)80}$ (6, 96) THINK: 80 ÷ 16 = ? You see at once that each child would not receive 8 cookies, or 7 cookies. Try 6 as the quotient. (See A.) 6 × 16 = 96. So 6 is also too large.

B. $16\overline{)80}$ (5, 80) Try 5. (See B.) 5 × 16 = 80. Is 5 the correct quotient? Each child should receive 5 cookies.

When dividing by the numbers from 11 to 19, you may have to try several numbers to get the correct quotient. That is why it is helpful to use a table like the one on page 95.

2. In these examples which quotients are too large? Which are correct? How can you tell?

a.	*b.*	*c.*	*d.*	*e.*
9	8	5	9	5
$13\overline{)106}$	$16\overline{)95}$	$17\overline{)75}$	$15\overline{)125}$	$14\overline{)80}$
117	128	85	135	70

REMEMBER: **the remainder must always be smaller than the number by which you are dividing.**

Divide and check:

	a	*b*	*c*	*d*
3.	$12\overline{)60}$	$19\overline{)95}$	$14\overline{)42}$	$16\overline{)96}$
4.	$18\overline{)169}$	$17\overline{)102}$	$13\overline{)110}$	$15\overline{)108}$
5.	$11\overline{)968}$	$18\overline{)972}$	$19\overline{)874}$	$18\overline{)864}$
6.	$15\overline{)645}$	$12\overline{)168}$	$15\overline{)1065}$	$16\overline{)736}$
7.	$14\overline{)504}$	$12\overline{)648}$	$17\overline{)1428}$	$13\overline{)871}$
8.	$17\overline{)425}$	$13\overline{)338}$	$14\overline{)1190}$	$18\overline{)1350}$

DIAGNOSTIC TEST IN FINDING QUOTIENTS

This test will show you the kinds of examples in finding quotients on which you may need more practice. If you have errors in more than one example in a row, turn for study and practice to the page given at the right of the row.

	a	*b*	*c*	*d*	
1.	$28\overline{)63}$	$97\overline{)456}$	$81\overline{)402}$	$76\overline{)423}$	(74)
2.	$37\overline{)72}$	$35\overline{)133}$	$26\overline{)51}$	$64\overline{)310}$	(76)
3.	$43\overline{)410}$	$95\overline{)926}$	$78\overline{)716}$	$31\overline{)308}$	(77)
4.	$38\overline{)150}$	$49\overline{)339}$	$57\overline{)454}$	$26\overline{)186}$	(88)
5.	$29\overline{)237}$	$38\overline{)300}$	$26\overline{)209}$	$49\overline{)401}$	(88)
6.	$39\overline{)272}$	$28\overline{)181}$	$27\overline{)160}$	$29\overline{)186}$	(89)
7.	$16\overline{)70}$	$14\overline{)83}$	$15\overline{)91}$	$17\overline{)87}$	(96)
8.	$12\overline{)103}$	$19\overline{)132}$	$18\overline{)144}$	$16\overline{)125}$	(96)

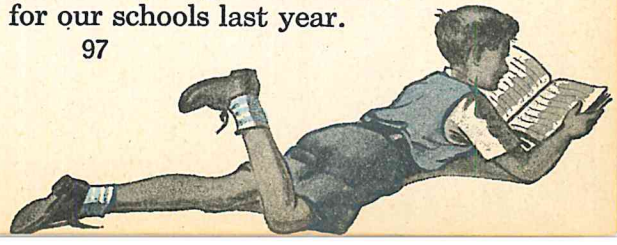
Do not be satisfied until you can work every example in the test correctly.

If you missed any of the examples in the test, can you tell the reasons for your errors?

*INTERESTING FACTS TO FIND OUT

If you do not need more practice in finding quotients at this time, you may report to your class on any of the topics below.

1. How time lines are used in history books.
2. Graphs found in newspapers.
3. The kinds of graphs found in textbooks and reference books.
4. Different ways of measuring weight used today.
5. The money spent for our schools last year.



REVIEWING WHAT YOU HAVE LEARNED

In this lesson you will review all of the important kinds of examples you have studied. Check each example and be sure that your answer is correct.

	a	*b*	*c*	*d*
1.	$73\overline{)1971}$	$59\overline{)4286}$	$21\overline{)84065}$	$49\overline{)3375}$
2.	$36\overline{)14503}$	$17\overline{)1258}$	$69\overline{)1237}$	$89\overline{)5340}$
3.	$96\overline{)7700}$	$82\overline{)8020}$	$78\overline{)62734}$	$19\overline{)7657}$

DRAWING PICTURES TO HELP IN SOLVING PROBLEMS

It will help you to solve these problems if you draw pictures illustrating the facts given in the problems.

1. Find the perimeter of a farm that is $\frac{1}{4}$ mile long and $\frac{3}{4}$ mile wide.
2. How many square inches are there in a rectangle 3 inches wide and 4 inches long?
3. How many feet of fence would it take to go around a square play yard each side of which is 18 feet?
4. Show how you could divide 3 cookies equally among 4 children so that each one would get the same amount. What part of a cookie would each one receive?
5. Suppose that you have a ribbon 6 inches long and wish to divide it into four equal parts. How long should each part be?
6. Which is more, $\frac{3}{4}$ inch or $\frac{7}{8}$ inch? How much more?
7. How many minutes is it from 3:17 o'clock to 4:10 o'clock?
8. How many quarter apples are there in 3 apples?
9. What is the area of a floor 12 feet long and 11 feet wide?

FINAL TEST IN DIVISION

If you can work all of these examples correctly, you have learned to divide very well. Express all remainders with **r**, not as fractions.

Set I

	a	*b*	*c*	*d*
1.	$23\overline{)575}$	$35\overline{)14725}$	$47\overline{)2868}$	$59\overline{)3845}$
2.	$94\overline{)6476}$	$24\overline{)1824}$	$77\overline{)7086}$	$56\overline{)5040}$

Set II

1.	$28\overline{)1832}$	$36\overline{)1476}$	$54\overline{)3128}$	$27\overline{)21762}$
2.	$98\overline{)7856}$	$26\overline{)2376}$	$16\overline{)9123}$	$46\overline{)2439}$

HOW WELL DO YOU REMEMBER?

1. How can you tell that the quotient in an example is too large? Give an example showing this.
2. How can you tell where to place the first quotient figure?
3. When should you write a 0 in the quotient? Tell why.
4. Explain how to find the quotient in this example: $28\overline{)167}$.
5. How does mental multiplication help in division?
6. What kinds of errors do people make in division?
7. What must you know in order to find the area of a field?
8. What is a picture graph?
9. What is a time line?
10. Write in two ways: seven and nine tenths.
11. Which is most, .3, .03, or .003?
12. What part of a foot is 1 inch? What part of a yard is 1 inch? Show that our system of measuring length by yards, feet, and inches is not a decimal system.

LET'S PRACTICE

Practice one set of examples at a time. If you need more practice, work the same set several times. Keep a record of your scores so that you can see how your work improves.

Set I

1. $\begin{array}{r} 858 \\ 71 \\ 2719 \\ 4416 \\ 689 \\ 9737 \\ \hline \end{array}$

2. $\begin{array}{r} 29003 \\ -18904 \\ \hline \end{array}$

3. $\begin{array}{r} \$4.83 \\ \times 95 \\ \hline \end{array}$

4. $\begin{array}{r} 8\frac{3}{4} \\ +5\frac{3}{4} \\ \hline \end{array}$

5. $35\overline{)11690}$

6. $\begin{array}{r} 9\frac{2}{3} \\ -4\frac{2}{3} \\ \hline \end{array}$

7. $13\overline{)3393}$

8. $\begin{array}{r} 849 \\ \times 384 \\ \hline \end{array}$

9. $46\overline{)4270}$

10. $\begin{array}{r} 87.5 \\ -87.1 \\ \hline \end{array}$

Set II

1. $\begin{array}{r} .88 \\ 3.99 \\ 18.62 \\ 47.58 \\ 54.73 \\ 9.75 \\ \hline \end{array}$

2. $\begin{array}{r} \$481.75 \\ -480.97 \\ \hline \end{array}$

3. $\begin{array}{r} 948 \\ \times 627 \\ \hline \end{array}$

4. $\begin{array}{r} 9\frac{5}{8} \\ +6\frac{3}{8} \\ \hline \end{array}$

5. $56\overline{)2495}$

6. $\begin{array}{r} 7 \\ -4\frac{1}{2} \\ \hline \end{array}$

7. $\begin{array}{r} 9.84 \\ -2.74 \\ \hline \end{array}$

8. $\begin{array}{r} \$7.56 \\ \times 600 \\ \hline \end{array}$

9. $\begin{array}{r} .875 \\ +.125 \\ \hline \end{array}$

10. $96\overline{)9024}$

USING THE VOCABULARY OF ARITHMETIC

Give sentences showing how we use these words in arithmetic.

quotient	compare	square foot	price	ounce
tenth	purchase	A.D.	bushels	century
graph	decimal	reduction	place value	pint
degree	acre	approximate	liquid measure	quantity

MEASURING GROWTH IN PROBLEM SOLVING

1. If 4 pounds of bacon cost $1.56, how much does one pound cost?

2. John can ride a mile on his bicycle in $4\frac{1}{4}$ minutes. George can ride a mile in $3\frac{3}{4}$ minutes. How much less time than it takes John does it take George to ride a mile?

3. On a bicycle trip John rode 52.7 miles the first day, 47.0 miles the second day, and 46.5 miles the third day. How many miles did he ride in all?

4. How much do 300 pairs of shoes cost at $4.50 a pair?

5. A farmer raised 225 bushels of wheat on a 15-acre field. How many bushels did he raise on an acre?

6. What is the area of a flower bed that is 18 feet long and 12 feet wide?

7. How much will the wire for a fence around a play yard that is 30 feet long and 24 feet wide cost at 6 cents a foot?

8. Mary's mother needs $4\frac{3}{4}$ yards of cloth for some sewing work. She has two pieces, one $1\frac{1}{4}$ yards long, the other 2 yards long. How much more cloth does she need?

9. A grocer paid $2.25 for 25 quarts of milk. He sold the milk at 11 cents a quart. How much more did he receive a quart for the milk than he paid for it?

10. An 8-ounce glass of honey cost 12 cents. A 1-pound glass cost 16 cents. How much less a pound was the honey in the pound glass than in the 8-ounce glass?

What Your Score Means

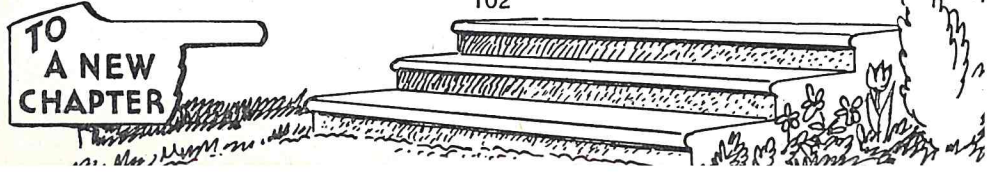
Unsatisfactory	Fair	Good	Excellent
0 1 2 3 4	5 6	7 8	9 10

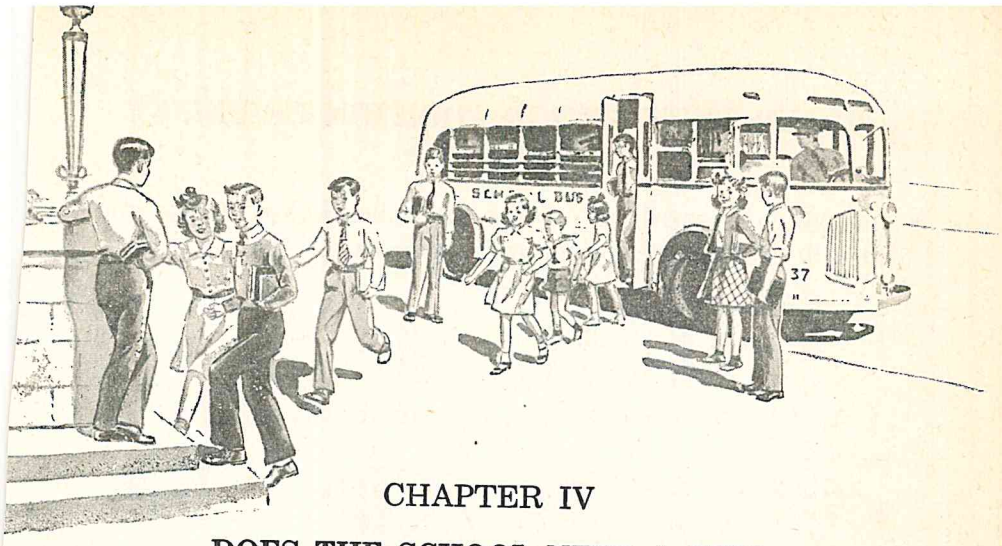
UP THE STEPS TO A NEW CHAPTER

This test will help you to find out how well you can do the work in arithmetic that you have studied. When you copy the numbers, be sure to leave enough space for your work.

1. Reduce to lowest terms: $\frac{15}{18}$, $\frac{9}{12}$, $\frac{16}{20}$. (23)
2. How much is $\frac{1}{6}$ of 1620? (11)
3. What part of a pound is 12 ounces? (24)
4. Divide 972 by 24. (17)
5. Express in simplest form: $8\frac{4}{4}$, $6\frac{3}{2}$, $9\frac{6}{3}$. (23)
6. Find the sum of $9\frac{1}{4}$, $8\frac{1}{4}$, $9\frac{3}{4}$, and $6\frac{3}{4}$. (26)
7. Supply the missing numerators: $4 = 3\frac{\ }{2}$; $1\frac{3}{8} = \frac{\ }{8}$. (23)
8. How much less than 10 yards is $6\frac{1}{2}$ yards? (28)
9. Subtract $3\frac{3}{4}$ from $11\frac{1}{4}$. (29)
10. Work this example: 76×869. (12)
11. What is the product of 495 and 908? (58)
12. Multiply \$4.80 by 600. (59)
13. Express as fractions: .1, .29, .904. (38)
14. Express as decimals: $3\frac{3}{10}$, $9\frac{17}{100}$, $16\frac{128}{1000}$. (38)
15. Add: $26.7 + 1.9 + .7 + 168.7 = ?$ (42)
16. Subtract 39.648 from 89.720. Check by addition. (49)
17. Divide 3298 by 67. Check your answer. (74)
18. Divide 4176 by 48. (77)
19. Divide 20445 by 29. Check your work. (89)
20. Divide 1496 by 16. Check your work. (96)

After your paper has been marked, correct at once any errors you made. For help turn to the pages given at the right of the test. Do not go on to the next chapter until you are sure that you know how to work all of the examples in the test correctly.





CHAPTER IV

DOES THE SCHOOL NEED A BUS?

Mr. Jones, the school principal, asked the children in District School No. 20 to tell how far they had to walk to get to school. The school district had very little money and could not afford a school bus. Below is a list of the five pupils who had to walk the longest distances.

Ben	$3\frac{1}{4}$ mi.
Jennie	$2\frac{3}{4}$ mi.
Joe	$2\frac{1}{2}$ mi.
Anna	$1\frac{7}{8}$ mi.
Arthur	$1\frac{3}{8}$ mi.

1. How far did Ben have to walk each day in going to and from school? Could you walk the distance each way in an hour?

2. How far did Jennie have to walk each day? Joe? Anna? Arthur?

3. How much farther from school than Jennie lived did Ben live?

*4. In some places the state helps a school district to pay for school buses for children who live far out in the country. Is this done in your state? If so, what is the plan of state aid? How does the state get the money?

*5. How far from the school do the children in your class live?

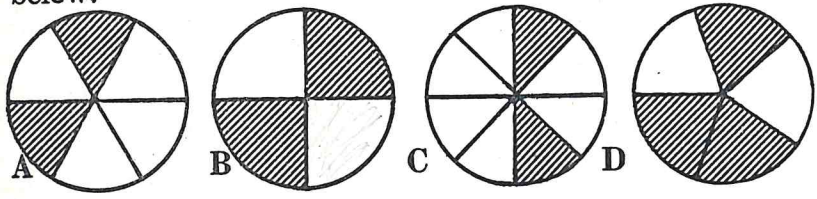
READINESS TEST FOR ADDITION OF UNLIKE FRACTIONS

If you can work all of the examples below easily and quickly, you are ready for work with unlike fractions.

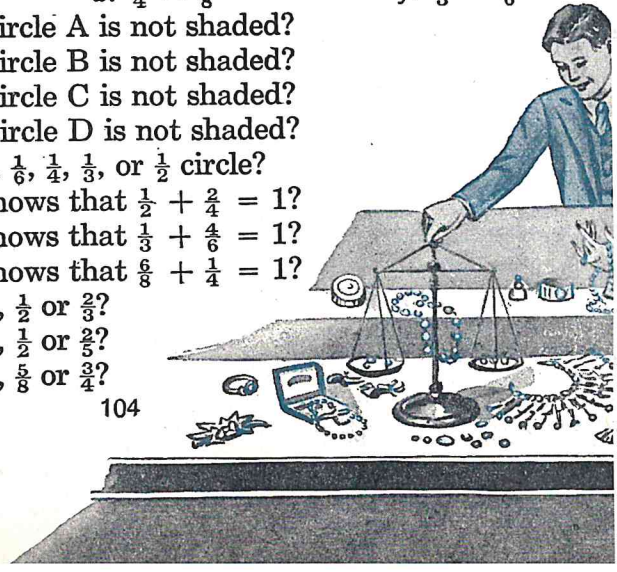
I. Find the sums:

1. $\begin{array}{r} \frac{1}{4} \\ \frac{1}{4} \\ \hline \end{array}$
2. $\begin{array}{r} \frac{3}{4} \\ \frac{1}{4} \\ \hline \end{array}$
3. $\begin{array}{r} \frac{2}{3} \\ \frac{2}{3} \\ \hline \end{array}$
4. $\begin{array}{r} 3\frac{1}{3} \\ 5\frac{1}{3} \\ \hline \end{array}$
5. $\begin{array}{r} \frac{1}{2} \\ 9\frac{1}{2} \\ \hline \end{array}$
6. $\begin{array}{r} 8\frac{3}{4} \\ \frac{3}{4} \\ \hline \end{array}$

II. Use the circles to find the answers to the questions below:



1. Which circle is $\frac{1}{2}$ shaded?
2. Which circle is $\frac{1}{3}$ shaded?
3. Which circle is $\frac{1}{4}$ shaded?
4. Use the circles above to find the missing numerators:
   - *a.* $\frac{1}{2} = \frac{?}{4}$
   - *b.* $\frac{1}{2} = \frac{?}{8}$
   - *c.* $\frac{1}{2} = \frac{?}{6}$
   - *d.* $\frac{1}{4} = \frac{?}{8}$
   - *e.* $\frac{1}{3} = \frac{?}{6}$
   - *f.* $\frac{2}{3} = \frac{?}{6}$
5. What part of circle A is not shaded?
6. What part of circle B is not shaded?
7. What part of circle C is not shaded?
8. What part of circle D is not shaded?
9. Which is most, $\frac{1}{6}$, $\frac{1}{4}$, $\frac{1}{3}$, or $\frac{1}{2}$ circle?
10. Which circle shows that $\frac{1}{2} + \frac{2}{4} = 1$?
11. Which circle shows that $\frac{1}{3} + \frac{4}{6} = 1$?
12. Which circle shows that $\frac{6}{8} + \frac{1}{4} = 1$?
13. Which is more, $\frac{1}{2}$ or $\frac{2}{3}$?
14. Which is more, $\frac{1}{2}$ or $\frac{2}{5}$?
15. Which is more, $\frac{5}{8}$ or $\frac{3}{4}$?



HOW GOLD IS MEASURED

Margaret's mother bought her a ring for her birthday. It was made of "18 carat" gold. Do you know what 18 carat gold means?

1. Purest gold is 24 carat gold. When we speak of 18 carat gold, we mean that the gold is $\frac{18}{24}$ pure, that is, there are 18 parts of pure gold and 6 parts of other metals in it. Reduce the fraction $\frac{18}{24}$ to lowest terms to tell what part of Margaret's ring was gold.

2. Tell what part is gold in a 16 carat ring; in a 14 carat ring.

3. White gold has 12 carats gold and 12 carats silver. What part of white gold is gold? what part is silver?

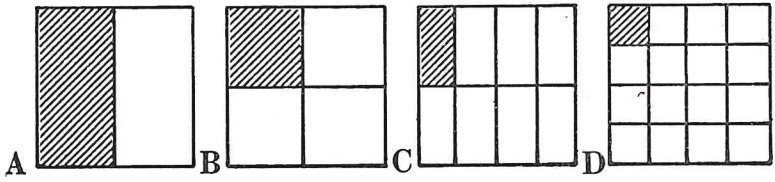
4. A 14 carat gold ring has $8\frac{1}{4}$ carats of silver and $1\frac{3}{4}$ carats of copper. Show that there are in all 24 carats in this ring.

*5. Gold is sold by the ounce (**Troy** weight) to the United States Mint. Recently the price was $35 an ounce. How much was this a pound? (1 lb. Troy = 12 oz. = 5760 grains). Our common 16-ounce pound is called **avoirdupois** weight. (1 lb. = 7000 grains.)

*6. In the gem industry a carat is the standard of weight. Diamonds are sold by the carat. The largest diamond ever found weighed about 1000 carats. Find out how much the diamond weighed if a carat by weight equals approximately 4 grains. Why are gold and diamonds weighed so exactly?

COMPARING FRACTIONS

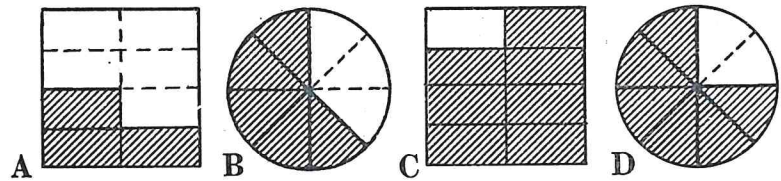
Use the drawings to help you answer the questions below:



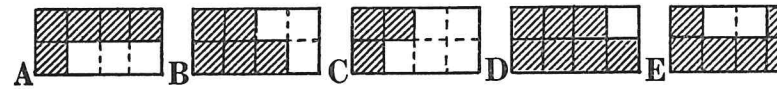
1. Arrange these fractions in order of their value: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{16}$, $\frac{1}{2}$. Write the fraction of largest value first.
2. How many fourths are there in $\frac{1}{2}$? how many eighths? how many sixteenths?
3. How many eighths are there in $\frac{1}{4}$? in $\frac{2}{4}$? in $\frac{3}{4}$?
4. How many sixteenths are there in $\frac{1}{8}$? in $\frac{1}{4}$? in $\frac{1}{2}$? in $\frac{3}{4}$?
5. Which is more?
   a. $\frac{1}{2}$ or $\frac{3}{4}$ *b.* $\frac{1}{2}$ or $\frac{3}{16}$ *c.* $\frac{1}{4}$ or $\frac{5}{16}$ *d.* $\frac{3}{8}$ or $\frac{3}{16}$ *e.* $\frac{3}{4}$ or $\frac{1}{16}$
6. Arrange these fractions in order of their size.
   a. $\frac{1}{3}$, $\frac{1}{8}$, $\frac{3}{4}$ *b.* $\frac{4}{16}$, $\frac{1}{2}$, $\frac{3}{4}$ *c.* $\frac{4}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ *d.* $\frac{3}{16}$, $\frac{1}{4}$, $\frac{1}{8}$

LET'S TELL THE STORIES

1. Which drawing below tells the story, $\frac{1}{2} + \frac{1}{8} = \frac{5}{8}$?

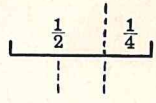


2. Which of the above drawings tells the story:
   a. $\frac{1}{4} + \frac{1}{8} = \frac{3}{8}$? *b.* $\frac{3}{4} + \frac{1}{8} = \frac{7}{8}$? *c.* $\frac{3}{8} + \frac{3}{8} = \frac{3}{4}$?
3. Write the example shown by each drawing below.



HOW TO ADD UNLIKE FRACTIONS

1. With your ruler draw a line $\frac{1}{2}$ inch long. Now make it $\frac{1}{4}$ inch longer. How long is the whole line? Use your ruler to find out.



You can also find the length of the line by adding $\frac{1}{2}$ inch and $\frac{1}{4}$ inch.

$$\begin{array}{r} \frac{1}{2} = \frac{2}{4} \\ +\ \frac{1}{4} = \frac{1}{4} \\ \hline \frac{3}{4} \end{array}$$

THINK: I cannot add $\frac{1}{2}$ and $\frac{1}{4}$ because they do not have the same denominator. They must be changed to **like fractions.** I know that $\frac{1}{2} = \frac{2}{4}$. So I shall change $\frac{1}{2}$ to $\frac{2}{4}$. I can add $\frac{2}{4}$ and $\frac{1}{4}$, for they are like fractions.

The sum is $\frac{3}{4}$.

The line is $\frac{3}{4}$ inch long.

Fractions such as $\frac{1}{2}$ and $\frac{1}{4}$ are called **unlike fractions. Before unlike fractions can be added you must always change them to the same name or denominator.** The new denominator must be a number large enough to contain both of the unlike denominators without a remainder.

2. Write three pairs of like fractions. Write three pairs of unlike fractions.

3. Use your ruler to find how much $\frac{1}{2}$ inch plus $\frac{1}{8}$ inch is.

4. You can see on your ruler that $\frac{1}{2}$ inch equals $\frac{4}{8}$ inch. You can add $\frac{1}{2}$ inch and $\frac{1}{8}$ inch as shown below:

$$\begin{array}{r} \frac{1}{2} = \frac{4}{8} \\ +\ \frac{1}{8} = \frac{1}{8} \\ \hline \frac{5}{8} \end{array}$$

Are $\frac{1}{2}$ and $\frac{1}{8}$ like or unlike fractions?

Why do we change $\frac{1}{2}$ to $\frac{4}{8}$?

Why do we not need to change $\frac{1}{8}$?

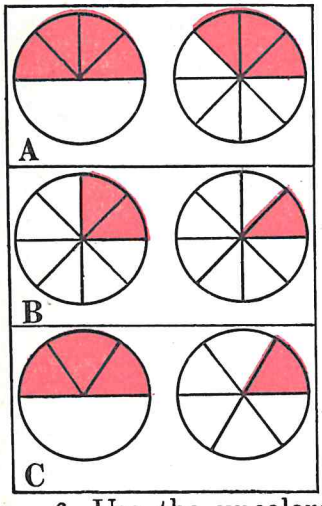
The line is $\frac{5}{8}$ inch long.

REMEMBER: **Only like fractions can be added.**

5. Use your ruler to find how much $\frac{1}{2}$ inch plus $\frac{3}{8}$ inch is. Then find the sum by addition.

6. Draw a line $\frac{1}{4}$ inch long. Extend it $\frac{5}{8}$ inch. Use your ruler to find the length of the whole line. Then find its length by addition.

USING PICTURES IN ADDING UNLIKE FRACTIONS



1. The colored parts of two circles in Box A show that $\frac{1}{2} + \frac{3}{8} = \frac{7}{8}$. Explain.

2. Use the circles in Box B to show that $\frac{1}{4}$ plus $\frac{1}{8}$ equals $\frac{3}{8}$.

3. Use the circles in Box C to show that $\frac{1}{2}$ plus $\frac{1}{6}$ equals $\frac{4}{6}$, or $\frac{2}{3}$.

4. Look at the parts of the circles in Box A that are not colored. Use them to show that $\frac{1}{2} + \frac{5}{8}$ equals $\frac{9}{8}$, or $1\frac{1}{8}$.

5. Use the uncolored parts of the circles in Box B to show that $\frac{3}{4} + \frac{7}{8}$ equals $\frac{13}{8}$ or $1\frac{5}{8}$.

6. Use the uncolored parts of the circles in Box C to show that $\frac{1}{2} + \frac{5}{6}$ equals $\frac{8}{6}$, or $1\frac{1}{3}$.

*7. Draw two equal circles. Shade them to show that $\frac{3}{4} + \frac{1}{8}$ equals $\frac{7}{8}$.

*8. Find the part of the two circles that is not shaded.

FRACTIONS TO BE LEARNED

The unlike fractions that you will add and subtract most frequently are halves, fourths, and eighths. To save time it will pay you to memorize the fractions given below.

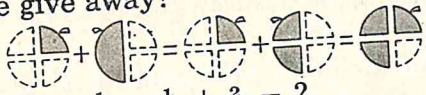
1. $\frac{1}{2} = \frac{2}{4}$ 2. $\frac{1}{2} = \frac{4}{8}$ 3. $\frac{1}{4} = \frac{2}{8}$ 4. $\frac{3}{4} = \frac{6}{8}$

In adding halves and fourths, change halves to fourths.
In adding halves and eighths, change halves to eighths.
In adding fourths and eighths, change fourths to eighths.

REMEMBER: **Fractions cannot be added until they have the same denominator.**

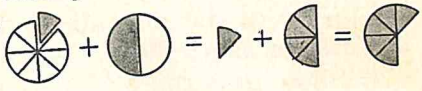
ADDING HALVES, FOURTHS, AND EIGHTHS

1. Tom divided an apple into fourths. He gave $\frac{1}{4}$ of the apple to Ann and $\frac{1}{2}$ of the apple to John. What part of the apple did he give away?



THINK: $\frac{1}{4} + \frac{1}{2} = \frac{1}{4} + \frac{2}{4} = ?$

2. Mary baked a cake. She cut it into eighths. She ate one eighth for lunch and the family ate one half of the cake for dinner. What part of the cake was eaten?



THINK: $\frac{1}{8} + \frac{1}{2} = \frac{1}{8} + \frac{4}{8} = ?$

3. Study the examples below until you understand the work. Then copy and work them with your book closed.

a. $\frac{1}{2} = \frac{4}{8}$, $\frac{3}{8} = \frac{3}{8}$, $\frac{7}{8}$

b. $\frac{1}{4} = \frac{2}{8}$, $\frac{1}{8} = \frac{1}{8}$, $\frac{3}{8}$

c. $\frac{1}{8} = \frac{1}{8}$, $\frac{3}{4} = \frac{6}{8}$, $\frac{7}{8}$

When fractions have the same denominator, we say that they have a **common denominator.** Thus $\frac{3}{8}$ and $\frac{2}{8}$ have the common denominator 8.

4. Change the fractions $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{3}{4}$ so that all will have the common denominator 8:

THINK: $\frac{1}{2} = \frac{?}{8}$ $\quad \frac{1}{4} = \frac{?}{8}$ $\quad \frac{3}{4} = \frac{?}{8}$

First tell how you must change the denominators. Then add the fractions.

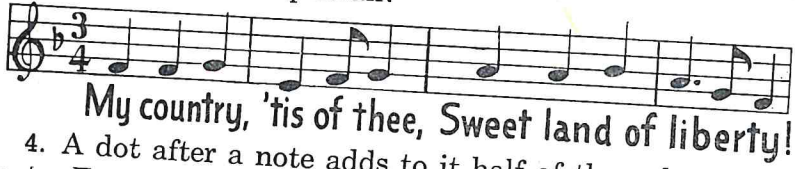
	a	*b*	*c*	*d*
5.	$\frac{1}{4} + \frac{3}{8} =$	$\frac{1}{2} + \frac{3}{8} =$	$\frac{1}{2} + \frac{1}{4} =$	$\frac{5}{8} + \frac{1}{4} =$
6.	$\frac{3}{4} + \frac{1}{2} =$	$\frac{1}{4} + \frac{5}{8} =$	$\frac{1}{8} + \frac{1}{2} =$	$\frac{3}{8} + \frac{1}{2} =$
7.	$\frac{1}{4} + \frac{1}{2} =$	$\frac{1}{8} + \frac{1}{4} =$	$\frac{3}{8} + \frac{1}{4} =$	$\frac{1}{2} + \frac{1}{8} =$

8. Tell what you must do to add $\frac{3}{8}$ and $\frac{1}{2}$.

Do you know this song?

Look at the figures $\frac{2}{4}$. We call them the **signature** of each measure. The 2 tells us that there are two beats to the measure. The 4 tells us that each beat is equal to a quarter note.

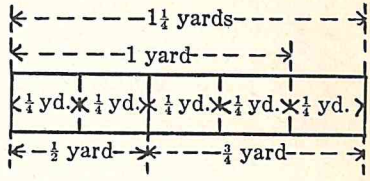
1. Look at the song above. How many notes are there in the first measure? What kinds of notes are they?
2. Show that the values of the notes in each measure in the song above add up to $\frac{2}{4}$. For example, in the first measure the values are $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{4}{8} = \frac{2}{4}$.
3. What is the signature of the song below? Show that the values of the notes in each measure in the song add up to $\frac{3}{4}$. What does the $\frac{3}{4}$ mean?



4. A dot after a note adds to it half of the value of the note. For example, a dot after a quarter note adds $\frac{1}{2}$ of $\frac{1}{4}$, or $\frac{1}{8}$, to the value of the quarter note. What is the value of this dotted note, $\dot{\text{♩}}$. in the second measure of the song above?
5. Show that in each measure below, the values of the notes and the rest add up to $\frac{4}{4}$. (The value of the rest $\mathcal{z}$ is $\frac{1}{4}$ note.)

ADDING UNLIKE FRACTIONS WHEN SUM IS GREATER THAN ONE

1. Betty sewed two pieces of cloth together. One was $\frac{1}{2}$ yard long, the other $\frac{3}{4}$ yard long. How long a strip did they make?



$\frac{1}{2} = \frac{2}{4}$
$\frac{3}{4} = \frac{3}{4}$
$\frac{5}{4} = 1\frac{1}{4}$

THINK: $\frac{1}{2}$ yd. + $\frac{3}{4}$ yd. = ?
Why do we change $\frac{1}{2}$ to $\frac{2}{4}$?
How do we get the $\frac{5}{4}$?
How do we change $\frac{5}{4}$ to $1\frac{1}{4}$?
Betty had $1\frac{1}{4}$ yd. of cloth.

2. Study the examples below. Then copy, and work the examples with your book closed.

a.
$\frac{3}{4} = \frac{6}{8}$
$\frac{5}{8} = \frac{5}{8}$
$\frac{1}{8} = \frac{1}{8}$
$\frac{12}{8} = 1\frac{4}{8} = 1\frac{1}{2}$

b.
$\frac{1}{4} = \frac{1}{4}$
$\frac{1}{2} = \frac{2}{4}$
$\frac{1}{4} = \frac{1}{4}$
$\frac{4}{4} = 1$

c.
$\frac{1}{2} = \frac{4}{8}$
$\frac{3}{4} = \frac{6}{8}$
$\frac{7}{8} = \frac{7}{8}$
$\frac{17}{8} = 2\frac{1}{8}$

3. With your ruler draw a line $\frac{1}{2}$ inch long. Extend the line $\frac{1}{4}$ inch. Then extend the line $\frac{5}{8}$ inch more. How long is the line? To check your drawing, find the sum of $\frac{1}{2} + \frac{1}{4} + \frac{5}{8}$. Are the two results the same?

4. Use your ruler to show that the sums in 2 above are correct.

Find the sums:

	a	*b*	*c*	*d*	*e*	*f*	*g*
5.	$\frac{3}{4}$ $\frac{3}{8}$	$\frac{5}{8}$ $\frac{1}{2}$	$\frac{7}{8}$ $\frac{3}{4}$	$\frac{7}{8}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{2}$	$\frac{1}{2}$ $\frac{7}{8}$	$\frac{5}{8}$ $\frac{3}{4}$
6.	$\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{8}$	$\frac{1}{4}$ $\frac{1}{4}$ $\frac{1}{2}$	$\frac{3}{8}$ $\frac{3}{8}$ $\frac{1}{4}$	$\frac{1}{8}$ $\frac{3}{4}$ $\frac{1}{2}$	$\frac{2}{8}$ $\frac{1}{4}$ $\frac{1}{2}$	$\frac{3}{4}$ $\frac{1}{2}$ $\frac{1}{2}$	$\frac{7}{8}$ $\frac{3}{4}$ $\frac{1}{2}$

7. One day the Burns family used $\frac{1}{8}$ pound of butter for breakfast, $\frac{1}{2}$ pound for cooking, $\frac{1}{8}$ pound for lunch, and $\frac{1}{4}$ pound for dinner. How much butter did they use that day?

PRACTICING MUSIC LESSONS

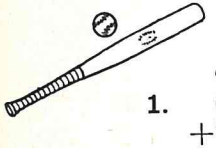
This is a record showing how long Helen practiced her music lesson before and after school each day for a week.

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Before School	$\frac{1}{4}$ hr.	$\frac{1}{4}$ hr.	$\frac{3}{4}$ hr.	$\frac{1}{2}$ hr.	$\frac{1}{2}$ hr.
After School	$\frac{1}{2}$ hr.	$\frac{3}{4}$ hr.	$\frac{3}{4}$ hr.	$\frac{3}{4}$ hr.	$\frac{1}{4}$ hr.

1. How long did she practice on Monday? on each of the other days?
2. How long did she practice in all before school?
3. How long did she practice in all after school?
4. On Saturday she practiced 50 minutes in the morning and 20 minutes in the afternoon. What part of an hour did she practice in the morning? in the afternoon?
5. During the year Helen takes in all 40 lessons. Her father pays Miss Hughes, her music teacher, 75 cents for each lesson. How much do the lessons cost a year?

*6. How much does it cost where you live to take private lessons in playing some musical instrument?

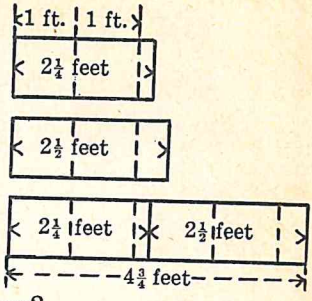
LET'S PRACTICE



	a	*b*	*c*	*d*	*e*
1.	$6.1 + 7.9$	$8 - 5\frac{3}{4}$	365×408	$5\frac{3}{4} + 7\frac{3}{4}$	$27.89 - 9.96$
2.	$\frac{3}{4} + \frac{1}{8}$	$6\frac{3}{4} - 5\frac{1}{4}$	$25\overline{)1000}$	$9.875 + 1.125$	$58\overline{)5162}$
3.	$11\frac{3}{8} - 5\frac{7}{8}$	$64.8 - 25.8$	$\frac{5}{8} + \frac{1}{2}$	$16\overline{)8128}$	$9\frac{1}{2} + 7\frac{1}{2}$

4. Add: $97.8 + 6.4 + 127.3 + 0.9 =$

ADDING MIXED NUMBERS



1. Joe has two boards, one $2\frac{1}{4}$ feet long, the other $2\frac{1}{2}$ feet long. How long are the two boards together?

$$\begin{array}{r} 2\frac{1}{4} = 2\frac{1}{4} \\ \underline{2\frac{1}{2} = 2\frac{2}{4}} \\ 4\frac{3}{4} \end{array}$$

THINK: $2\frac{1}{4}$ ft. + $2\frac{1}{2}$ ft. = ?
Why do we not change $2\frac{1}{4}$?
Why does $2\frac{1}{2} = 2\frac{2}{4}$?
Why can we add $2\frac{1}{4}$ and $2\frac{2}{4}$?
Is $4\frac{3}{4}$ expressed in simplest form?
The boards together are $4\frac{3}{4}$ feet long.

2. Study the work below. When you are sure you understand how the examples are worked, copy them without the work and find the sums.

a. $\begin{array}{r} 2\frac{1}{4} = 2\frac{2}{8} \\ \underline{3\frac{1}{8} = 3\frac{1}{8}} \\ 5\frac{3}{8} \end{array}$ *b.* $\begin{array}{r} \frac{3}{8} = \frac{3}{8} \\ \underline{4\frac{1}{2} = 4\frac{4}{8}} \\ 4\frac{7}{8} \end{array}$ *c.* $\begin{array}{r} 6\frac{3}{4} = 6\frac{6}{8} \\ \underline{\frac{1}{8} = \frac{1}{8}} \\ 6\frac{7}{8} \end{array}$

3. Ann worked in her garden $2\frac{1}{2}$ hours on Saturday morning and $1\frac{1}{4}$ hours in the afternoon. How long did she work in her garden in all?

Find the sums:

	a	*b*	*c*	*d*	*e*	*f*
4.	$3\frac{1}{2}$ $\underline{6\frac{1}{4}}$	$\frac{1}{8}$ $\underline{4\frac{3}{4}}$	$7\frac{1}{8}$ $\underline{5\frac{1}{2}}$	$6\frac{1}{2}$ $\underline{\frac{1}{4}}$	$9\frac{1}{4}$ $\underline{7\frac{3}{8}}$	$6\frac{3}{4}$ $\underline{8\frac{1}{8}}$
5.	$\frac{3}{8}$ $\underline{5\frac{1}{2}}$	$9\frac{1}{4}$ $\underline{6\frac{5}{8}}$	$9\frac{1}{4}$ $\underline{8\frac{1}{2}}$	$6\frac{1}{2}$ $\underline{4\frac{3}{8}}$	$7\frac{5}{8}$ $\underline{\frac{1}{4}}$	$6\frac{1}{8}$ $\underline{\frac{3}{4}}$

MIXED PRACTICE IN ADDITION OF FRACTIONS

1.	$5\frac{1}{2}$ $\underline{4\frac{1}{2}}$	$6\frac{1}{4}$ $\underline{5\frac{1}{4}}$	$7\frac{1}{2}$ $\underline{6\frac{1}{4}}$	$\frac{5}{8}$ $\underline{\frac{1}{2}}$	$\frac{1}{2}$ $\underline{3\frac{1}{8}}$	$9\frac{3}{4}$ $\underline{7\frac{3}{4}}$
2.	$6\frac{2}{3}$ $\underline{7\frac{1}{3}}$	$9\frac{3}{4}$ $\underline{7\frac{1}{8}}$	$\frac{3}{4}$ $\underline{\frac{1}{2}}$	$9\frac{1}{4}$ $\underline{5\frac{3}{4}}$	$4\frac{1}{4}$ $\underline{8\frac{1}{2}}$	$\frac{5}{8}$ $\underline{\frac{1}{2}}$

ADDING MIXED NUMBERS WITH CARRYING

1. Mary bought $3\frac{1}{2}$ yards of red ribbon and $2\frac{3}{4}$ yards of blue ribbon. How much ribbon did she buy?

$$3\tfrac{1}{2} = 3\tfrac{2}{4}$$
$$\underline{2\tfrac{3}{4} = 2\tfrac{3}{4}}$$
$$5\tfrac{5}{4} = 5 + 1\tfrac{1}{4} = 6\tfrac{1}{4}$$

THINK: $3\frac{1}{2}$ yd. $+ 2\frac{3}{4}$ yd. $= ?$
Why do we change $3\frac{1}{2}$ to $3\frac{2}{4}$?
How do we get $5\frac{5}{4}$?
How do we get $6\frac{1}{4}$?
Mary bought $6\frac{1}{4}$ yards of ribbon.

2. Study the work below. Then copy, and work the examples with your book closed.

a.
$$\tfrac{7}{8} = \tfrac{7}{8}$$
$$\underline{2\tfrac{1}{4} = 2\tfrac{2}{8}}$$
$$2\tfrac{9}{8} = 2 + 1\tfrac{1}{8} = 3\tfrac{1}{8}$$

b.
$$4\tfrac{3}{4} = 4\tfrac{6}{8}$$
$$\underline{2\tfrac{7}{8} = 2\tfrac{7}{8}}$$
$$6\tfrac{13}{8} = 6 + 1\tfrac{5}{8} = 7\tfrac{5}{8}$$

3. Mrs. Jones bought $3\frac{3}{4}$ yards of white lace and $2\frac{7}{8}$ yards of yellow lace. How much lace did she buy?

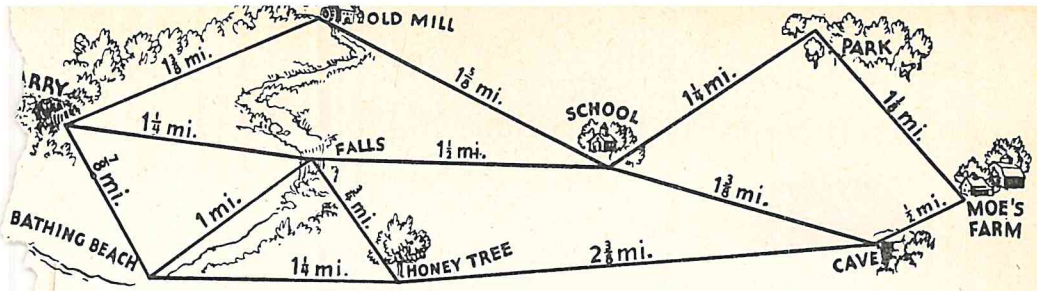
4. Draw a line $1\frac{3}{4}$ inches long. Extend it $\frac{1}{2}$ inch. Find the length of the line with your ruler and also by addition.

Find the sums:

	a	*b*	*c*	*d*	*e*	*f*
5.	$\frac{1}{2}$ $\underline{\frac{5}{8}}$	$\frac{3}{4}$ $\underline{\frac{3}{8}}$	$\frac{3}{4}$ $\underline{\frac{1}{2}}$	$\frac{7}{8}$ $\underline{\frac{1}{2}}$	$\frac{1}{4}$ $\underline{\frac{1}{2}}$	$\frac{5}{8}$ $\underline{\frac{3}{4}}$
6.	$7\frac{1}{2}$ $\underline{3\frac{1}{8}}$	$\frac{3}{4}$ $\underline{5\frac{1}{2}}$	$4\frac{1}{2}$ $\underline{\frac{3}{8}}$	$7\frac{5}{8}$ $\underline{6\frac{3}{4}}$	$7\frac{1}{4}$ $\underline{3\frac{5}{8}}$	$9\frac{3}{8}$ $\underline{6\frac{3}{4}}$
7.	$\frac{3}{4}$ $\underline{7\frac{5}{8}}$	$6\frac{1}{2}$ $\underline{4\frac{7}{8}}$	$8\frac{3}{4}$ $\underline{6\frac{3}{4}}$	$5\frac{7}{8}$ $\underline{6\frac{3}{4}}$	$5\frac{1}{2}$ $\underline{2\frac{5}{8}}$	$1\frac{7}{8}$ $\underline{7\frac{5}{8}}$

MIXED PRACTICE IN ADDING FRACTIONS

1.	$2\frac{1}{2}$ $\underline{3\frac{1}{4}}$	$6\frac{3}{8}$ $\underline{5\frac{1}{4}}$	$7\frac{5}{8}$ $\underline{6\frac{3}{4}}$	$8\frac{5}{8}$ $\underline{4\frac{7}{8}}$	$9\frac{1}{2}$ $\underline{6\frac{3}{4}}$	$7\frac{1}{4}$ $\underline{5\frac{1}{8}}$
2.	$\frac{3}{4}$ $\underline{\frac{1}{2}}$	$7\frac{3}{4}$ $\underline{8\frac{3}{4}}$	$9\frac{7}{8}$ $\underline{6\frac{3}{4}}$	$6\frac{1}{2}$ $\underline{\frac{1}{2}}$	$\frac{3}{4}$ $\underline{5\frac{7}{8}}$	$9\frac{3}{8}$ $\underline{6\frac{1}{2}}$



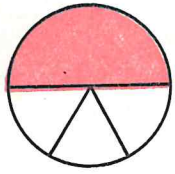
GIRL SCOUTS HIKE, TOO

On Saturdays the Girl Scout troop to which Hazel belongs often goes on hikes into the country. The map above was drawn by one of the girls. It shows some of the interesting places to which they like to hike.

1. How far is it from the school to the bathing beach?
2. How far is it from the school to Moe's farm if the girls go by way of the park? by way of the cave?
3. One day after school the troop walked from the school to Moe's farm by way of the park and back by way of the cave. How far did they walk in all?
4. A hike that the girls like best is to go first to the old mill, then to the quarry, then to the bathing beach for a swim. Then they go back to the school by way of the falls where they stop for a lunch. According to the map how long is this hike?
5. One day some girls walked to the cave, then to the honey tree, then to the bathing beach. After their swim they walked back to the school. How far did the girls walk in all?
6. One day the girls had a swimming contest at the bathing beach. Mary swam across the lake in $10\frac{3}{4}$ minutes. Jean swam across in 11 minutes. How much longer than it took Mary did it take Jean?

*7. Use the map to plan a hike and find the distance it would be.

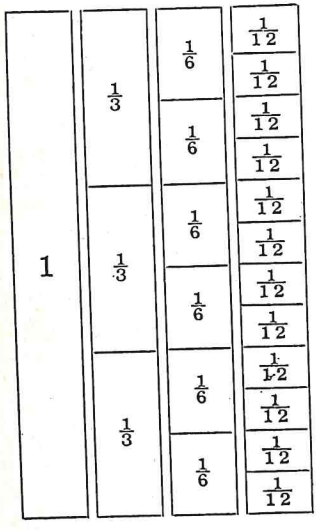
CHANGING THE FORM OF FRACTIONS



1. Use the circle at the left to show that $\frac{1}{2}$ equals $\frac{3}{6}$. Does $\frac{1}{2} + \frac{3}{6} = 1$?

2. Study the drawing below and prove that:

$\frac{1}{3} = \frac{2}{6}$ $\frac{1}{3} = \frac{4}{12}$ $\frac{1}{6} = \frac{2}{12}$ $\frac{2}{3} = \frac{4}{6}$ $\frac{2}{3} = \frac{8}{12}$



You have learned how to change $\frac{3}{6}$ to $\frac{1}{2}$ by dividing both 3 and 6 by 3.

$$\frac{3 \div 3}{6 \div 3} = \frac{1}{2}$$

3. How can you change $\frac{1}{2}$ to $\frac{3}{6}$? You can see that to change $\frac{1}{2}$ to $\frac{3}{6}$ you must multiply both terms by 3.

$$\frac{1 \times 3}{2 \times 3} = \frac{3}{6}$$

4. How can you change $\frac{1}{3}$ to $\frac{2}{6}$?

$$\frac{1 \times 2}{3 \times 2} = \frac{2}{6}$$

THINK: By what number must I multiply each term to change $\frac{1}{3}$ to $\frac{2}{6}$? You can see that you must multiply each term by 2.

5. Show by reduction that $\frac{2}{6}$ equals $\frac{1}{3}$.

6. Tell how to change $\frac{1}{3}$ to $\frac{4}{12}$.

7. Show by reduction that $\frac{4}{12}$ equals $\frac{1}{3}$.

$$\frac{1 \times ?}{3 \times ?} = \frac{4}{12}$$

This work shows that **when both terms of a fraction are multiplied by the same number, the value of the fraction is not changed.**

8. How can you change $\frac{1}{2}$ to $\frac{2}{4}$? to $\frac{4}{8}$? to $\frac{6}{12}$? to $\frac{8}{16}$? to $\frac{5}{10}$?

9. How can you change $\frac{2}{3}$ to $\frac{4}{6}$? to $\frac{8}{12}$? to $\frac{6}{9}$?

10. Change to 16ths: $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{3}{8}$, $\frac{7}{8}$, $\frac{5}{8}$.

When both terms of a fraction are multiplied by the same number, the fraction is changed to higher terms.

CHANGE THE FORM—KEEP THE VALUE

To change $\frac{3}{4}$ to twelfths, divide 12 by the denominator of the fraction. THINK: $12 \div 4 = 3$. Multiply each term by 3.

Find the missing numerators:

	a	*b*	*c*	*d*	*e*
1.	$\frac{1}{2} = \frac{\quad}{8}$	$\frac{1}{10} = \frac{\quad}{20}$	$\frac{3}{4} = \frac{\quad}{12}$	$\frac{1}{4} = \frac{\quad}{12}$	$\frac{2}{5} = \frac{\quad}{20}$
2.	$\frac{1}{4} = \frac{\quad}{8}$	$\frac{1}{2} = \frac{\quad}{10}$	$\frac{5}{12} = \frac{\quad}{24}$	$\frac{7}{10} = \frac{\quad}{100}$	$\frac{3}{4} = \frac{\quad}{16}$
3.	$\frac{3}{4} = \frac{\quad}{8}$	$\frac{3}{8} = \frac{\quad}{16}$	$\frac{2}{5} = \frac{\quad}{10}$	$\frac{1}{2} = \frac{\quad}{12}$	$\frac{7}{8} = \frac{\quad}{16}$
4.	$\frac{1}{5} = \frac{\quad}{10}$	$\frac{1}{12} = \frac{\quad}{24}$	$\frac{1}{2} = \frac{\quad}{4}$	$\frac{5}{6} = \frac{\quad}{18}$	$\frac{3}{5} = \frac{\quad}{10}$
5.	$\frac{1}{6} = \frac{\quad}{12}$	$\frac{3}{4} = \frac{\quad}{24}$	$\frac{3}{10} = \frac{\quad}{20}$	$\frac{5}{8} = \frac{\quad}{16}$	$\frac{1}{2} = \frac{\quad}{16}$
6.	$\frac{1}{8} = \frac{\quad}{16}$	$\frac{1}{6} = \frac{\quad}{24}$	$\frac{1}{4} = \frac{\quad}{16}$	$\frac{4}{5} = \frac{\quad}{10}$	$\frac{5}{6} = \frac{\quad}{12}$

7. How can you change both $\frac{1}{2}$ and $\frac{3}{4}$ to eighths?

8. How can you change both $\frac{1}{2}$ and $\frac{2}{3}$ to sixths?

9. What is the smallest denominator to which you can change the fractions $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{8}$ so that all will have the same denominator? HINT: Can you use the largest of the denominators?

10. Change $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{5}{6}$ so that all will have the same denominator.

11. Can you change both $\frac{1}{2}$ and $\frac{1}{4}$ to sixths? Explain.

Change the following to pairs of like fractions:

	a	*b*	*c*	*d*	*e*
12.	$\frac{1}{2}, \frac{1}{8}$	$\frac{3}{4}, \frac{5}{8}$	$\frac{2}{3}, \frac{1}{6}$	$\frac{2}{3}, \frac{5}{6}$	$\frac{1}{2}, \frac{1}{6}$
13.	$\frac{3}{4}, \frac{1}{8}$	$\frac{1}{4}, \frac{1}{12}$	$\frac{1}{3}, \frac{5}{12}$	$\frac{1}{2}, \frac{7}{12}$	$\frac{3}{8}, \frac{1}{16}$
14.	$\frac{1}{2}, \frac{1}{10}$	$\frac{2}{5}, \frac{3}{10}$	$\frac{3}{10}, \frac{7}{20}$	$\frac{2}{3}, \frac{5}{6}$	$\frac{1}{10}, \frac{1}{100}$

Supply the missing numerators:

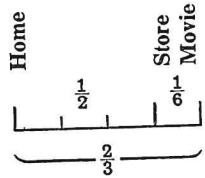
	a	*b*	*c*	*d*	*e*
15.	$6\frac{1}{2} = 6_{\frac{\quad}{4}}$	$7\frac{1}{4} = 7_{\frac{\quad}{8}}$	$6\frac{3}{4} = 6_{\frac{\quad}{8}}$	$7\frac{1}{2} = 7_{\frac{\quad}{6}}$	$5\frac{3}{8} = 5_{\frac{\quad}{16}}$
16.	$4\frac{1}{3} = 4_{\frac{\quad}{6}}$	$3\frac{2}{5} = 3_{\frac{\quad}{10}}$	$7\frac{7}{10} = 7_{\frac{\quad}{20}}$	$9\frac{5}{6} = 9_{\frac{\quad}{12}}$	$6\frac{1}{2} = 6_{\frac{\quad}{12}}$
17.	$8\frac{3}{4} = 8_{\frac{\quad}{8}}$	$7\frac{1}{2} = 7_{\frac{\quad}{10}}$	$9\frac{3}{4} = 9_{\frac{\quad}{20}}$	$6\frac{4}{5} = 6_{\frac{\quad}{15}}$	$7\frac{2}{3} = 7_{\frac{\quad}{15}}$

ADDING HALVES, THIRDS, AND SIXTHS

1. It is $\frac{1}{2}$ mile from John's home to the store and $\frac{1}{6}$ mile beyond the store to the movie theater. How far is it from John's home to the movie theater?

$$\begin{array}{r} \frac{1}{2} = \frac{3}{6} \\ +\frac{1}{6} = \frac{1}{6} \\ \hline \frac{4}{6} = \frac{2}{3} \end{array}$$

THINK: $\frac{1}{2}$ mi. + $\frac{1}{6}$ mi. = ?
Why do we change $\frac{1}{2}$ to $\frac{3}{6}$?
Why do we change $\frac{4}{6}$ to $\frac{2}{3}$?
It is $\frac{2}{3}$ mi. from John's house to the theater.



2. Study the examples below carefully. When you are sure that you understand how they are worked, copy them and work them with your book closed.

a. $2\frac{1}{3} = 2\frac{2}{6}$
$2\frac{1}{6} = 2\frac{1}{6}$
$4\frac{3}{6} = 4\frac{1}{2}$

b. $2\frac{1}{2} = 2\frac{3}{6}$
$\frac{1}{3} = \frac{2}{6}$
$2\frac{5}{6}$

c. $2\frac{1}{2} = 2\frac{3}{6}$
$4\frac{5}{6} = 4\frac{5}{6}$
$6\frac{8}{6} = 6 + 1\frac{2}{6} = 7\frac{1}{3}$

Notice that in example *b* it was necessary to change both $\frac{1}{2}$ and $\frac{1}{3}$ to sixths so that the example could be worked.

3. How must you change $\frac{1}{3}$ and $\frac{1}{6}$ before you can add them? Find their sum.

Find the sums of the following:

	a	*b*	*c*	*d*	*e*	*f*
4.	$\frac{1}{6}$ $\frac{1}{2}$	$\frac{1}{6}$ $\frac{1}{3}$	$\frac{1}{3}$ $\frac{1}{2}$	$\frac{2}{3}$ $\frac{1}{6}$	$\frac{2}{3}$ $\frac{1}{2}$	$\frac{1}{2}$ $\frac{5}{6}$
5.	$3\frac{1}{3}$ $2\frac{1}{6}$	$4\frac{1}{3}$ $2\frac{1}{2}$	$5\frac{1}{6}$ $6\frac{1}{2}$	$7\frac{1}{3}$ $\frac{1}{6}$	$8\frac{2}{3}$ $4\frac{1}{6}$	$\frac{1}{6}$ $5\frac{1}{3}$
6.	$6\frac{1}{2}$ $8\frac{5}{6}$	$5\frac{2}{3}$ $3\frac{5}{6}$	$8\frac{1}{2}$ $6\frac{2}{3}$	$7\frac{5}{6}$ $6\frac{1}{3}$	$8\frac{2}{3}$ $7\frac{1}{2}$	$9\frac{5}{6}$ $6\frac{1}{2}$

MIXED PRACTICE IN ADDING FRACTIONS

1.	2.	3.	4.	5.	6.
$6\frac{3}{4}$ $2\frac{1}{2}$	$\frac{3}{4}$ $6\frac{3}{4}$	$9\frac{3}{8}$ $6\frac{3}{4}$	$7\frac{2}{3}$ $\frac{5}{6}$	$\frac{1}{2}$ $9\frac{2}{3}$	$9\frac{3}{4}$ $\frac{7}{8}$

GRADED PRACTICE IN DIVISION

Work the examples one row at a time. If you need help, turn to the pages given at the right. Do not be satisfied until you can work every kind of example quickly and easily. Express remainders with **r.**

Set I

	a	*b*	*c*	
1.	$11\overline{)473}$	$23\overline{)483}$	$31\overline{)372}$	(14)
2.	$23\overline{)989}$	$36\overline{)828}$	$25\overline{)550}$	(14)
3.	$55\overline{)605}$	$22\overline{)330}$	$33\overline{)462}$	(17)
4.	$31\overline{)350}$	$23\overline{)506}$	$11\overline{)389}$	(17)
5.	$32\overline{)409}$	$24\overline{)758}$	$23\overline{)736}$	(17)

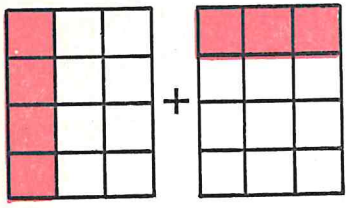
Set II

1.	$53\overline{)2259}$	$21\overline{)1134}$	$74\overline{)3922}$	(17)
2.	$56\overline{)2496}$	$48\overline{)1549}$	$80\overline{)6972}$	(17)
3.	$35\overline{)11790}$	$94\overline{)42582}$	$43\overline{)6668}$	(17)
4.	$49\overline{)8553}$	$83\overline{)2498}$	$57\overline{)2584}$	(76)
5.	$16\overline{)848}$	$15\overline{)975}$	$18\overline{)1458}$	(96)

Set III

1.	$95\overline{)9024}$	$37\overline{)3034}$	$64\overline{)6198}$	(77)
2.	$47\overline{)3255}$	$39\overline{)2728}$	$28\overline{)1896}$	(88)
3.	$85\overline{)1724}$	$16\overline{)800}$	$69\overline{)4855}$	(17)
4.	$87\overline{)52896}$	$37\overline{)11137}$	$96\overline{)77568}$	(89)
5.	$67\overline{)469335}$	$97\overline{)776194}$	$88\overline{)447040}$	(89)

LET'S TELL THE STORIES

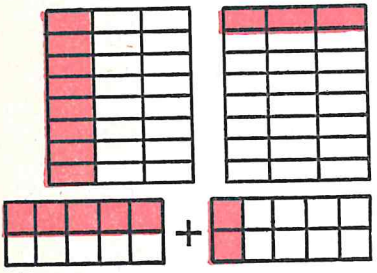


1. Into how many parts is each box divided?

2. What part of the first box is colored? What part of the second box is shaded?

3. Show that the picture tells the story, $\frac{1}{3} + \frac{1}{4} = \frac{4}{12} + \frac{3}{12}$, or $\frac{7}{12}$.

4. Make a drawing like the one above to show that $\frac{2}{3} + \frac{1}{4} = \frac{8}{12} + \frac{3}{12}$, or $\frac{11}{12}$.



5. What part of the first box is colored? of the second box?

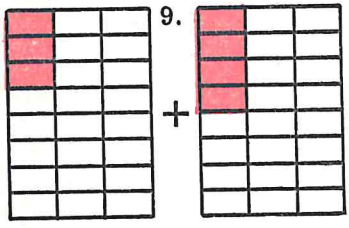
6. Use the drawing to add $\frac{1}{3} + \frac{1}{8}$.

7. Make a drawing to show $\frac{2}{3} + \frac{1}{8}$; $\frac{3}{8} + \frac{1}{3}$.

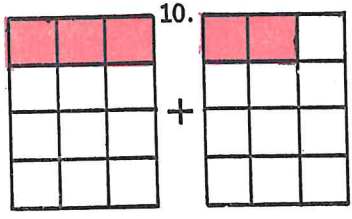
8. Show that the drawing at the left tells the story, $\frac{1}{2} + \frac{1}{5} = \frac{7}{10}$.

What story does each picture below tell?

9.



10.



11. Make drawings like 9 or 10 above showing the examples below. Then find the sums of the numbers.

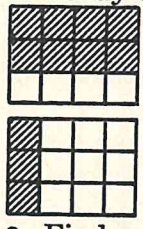
a. $\frac{3}{8} + \frac{1}{6} =$ *b.* $\frac{3}{4} + \frac{1}{6} =$ *c.* $\frac{5}{6} + \frac{1}{8} =$

12. Divide two squares into fifteenths. Use the squares to show that $\frac{1}{3} + \frac{1}{5} = \frac{8}{15}$.

ADDING FRACTIONS BY CHANGING BOTH DENOMINATORS

When you add unlike fractions like $\frac{1}{2}$ and $\frac{1}{4}$, or $\frac{3}{4}$ and $\frac{5}{8}$, you can see that one of the denominators is the **common denominator.** To add two fractions like $\frac{2}{3}$ and $\frac{1}{4}$ is more difficult, because neither denominator is the common denominator. Both denominators must be changed.

1. Study the work below to learn how to add $\frac{2}{3}$ and $\frac{1}{4}$.



$$\begin{array}{r} \frac{2}{3} = \frac{8}{12} \\ \frac{1}{4} = \frac{3}{12} \\ \hline \frac{11}{12} \end{array}$$

See the denominators 3 and 4. THINK: What number will contain both 3 and 4 without a remainder? To find the number, multiply 3 and 4. The product is 12. Change both $\frac{2}{3}$ and $\frac{1}{4}$ to twelfths. How is this done?

2. Find a common denominator for each of the following pairs of fractions. Then change the fractions to like fractions.

a. $\frac{1}{2}, \frac{1}{5}$ *b.* $\frac{1}{3}, \frac{1}{5}$ *c.* $\frac{1}{3}, \frac{1}{4}$ *d.* $\frac{3}{4}, \frac{2}{5}$ *e.* $\frac{1}{3}, \frac{1}{8}$ *f.* $\frac{1}{4}, \frac{1}{6}$

3. In adding $\frac{1}{4}$ and $\frac{1}{6}$, you can see that 24 is a common denominator, but that 12 is a smaller number that may be used as a common denominator. What two denominators may be used in adding $\frac{1}{6}$ and $\frac{1}{8}$? $\frac{1}{4}$ and $\frac{1}{10}$? $\frac{1}{6}$ and $\frac{1}{10}$? It is usually best to use the smallest denominator possible.

First tell the denominator to which you must change the fractions in each of these examples. Then find the sums.

	a	*b*	*c*	*d*	*e*	*f*	*g*
4.	$\frac{1}{2}$ $\frac{1}{5}$	$\frac{1}{3}$ $\frac{1}{4}$	$\frac{1}{4}$ $\frac{1}{6}$	$\frac{1}{3}$ $\frac{2}{5}$	$\frac{1}{3}$ $\frac{3}{8}$	$\frac{1}{3}$ $\frac{3}{4}$	$\frac{3}{4}$ $\frac{2}{5}$
5.	$5\frac{1}{4}$ $2\frac{2}{3}$	$6\frac{1}{2}$ $3\frac{2}{5}$	$7\frac{3}{4}$ $2\frac{1}{5}$	$6\frac{5}{6}$ $2\frac{1}{8}$	$4\frac{1}{4}$ $5\frac{5}{6}$	$7\frac{7}{8}$ $5\frac{3}{10}$	$7\frac{2}{3}$ $8\frac{3}{5}$

6. $\frac{1}{2} + \frac{1}{3} + \frac{1}{6} =$

7. $3\frac{1}{2} + 2\frac{1}{5} + \frac{3}{5} =$

8. $6\frac{3}{4} + 1\frac{1}{6} + \frac{5}{6} =$

9. $7\frac{3}{8} + 1\frac{1}{3} + \frac{1}{8} =$

10. $6\frac{2}{3} + 3\frac{3}{4} + \frac{2}{3} =$

11. $9\frac{1}{6} + 7\frac{1}{8} + 9\frac{1}{8} =$

WHEN DO WE CHANGE DENOMINATORS?

Study the work in these three examples carefully. Be ready to tell why the denominators are or are not changed.

a. $\frac{3}{8} = \frac{3}{8}$
$\frac{1}{4} = \frac{2}{8}$
$\frac{5}{8}$

b. $\frac{2}{3} = \frac{8}{12}$
$\frac{3}{4} = \frac{9}{12}$
$\frac{17}{12} = 1\frac{5}{12}$

c. $\frac{3}{4} = \frac{9}{12}$
$\frac{1}{6} = \frac{2}{12}$
$\frac{11}{12}$

1. Why are both fractions in example *a* not changed? How do we get the $\frac{5}{8}$? Can $\frac{5}{8}$ be reduced?

2. In example *b* why can we not use either 3 or 4 as the denominator in adding? How do we find the 12 that is used as the denominator in working the example?

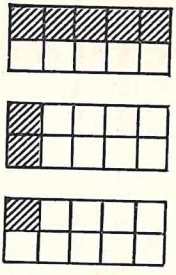
3. In example *c* can 24 also be used as the common denominator? Why do we use 12 as the common denominator?

When the denominators are not the same, always try first to see if the smaller denominator can be changed to the larger denominator.

Find the sums. Before you add, tell which of the denominators must be changed and what denominator should be used in each example.

	a	*b*	*c*	*d*	*e*	*f*
4.	$\frac{1}{4}$ $\frac{3}{4}$	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{2}$ $\frac{1}{6}$	$\frac{1}{2}$ $\frac{2}{3}$	$\frac{4}{5}$ $\frac{1}{2}$	$\frac{1}{6}$ $\frac{1}{4}$
5.	$\frac{3}{4}$ $\frac{1}{2}$	$\frac{5}{8}$ $\frac{7}{8}$	$\frac{3}{4}$ $\frac{5}{8}$	$\frac{2}{3}$ $\frac{3}{4}$	$\frac{1}{3}$ $\frac{5}{12}$	$\frac{3}{4}$ $\frac{7}{12}$
6.	$\frac{3}{4}$ $\frac{5}{6}$	$\frac{1}{4}$ $\frac{2}{3}$	$\frac{1}{6}$ $\frac{5}{6}$	$\frac{5}{6}$ $\frac{5}{8}$	$\frac{2}{3}$ $\frac{5}{6}$	$\frac{2}{5}$ $\frac{3}{10}$
7.	$5\frac{1}{4}$ $6\frac{3}{4}$ $8\frac{1}{4}$	$9\frac{3}{8}$ $5\frac{1}{4}$ $3\frac{1}{2}$	$6\frac{1}{2}$ $7\frac{2}{3}$ $6\frac{5}{6}$	$9\frac{1}{8}$ $4\frac{1}{2}$ $7\frac{1}{4}$	$7\frac{3}{10}$ $6\frac{4}{5}$ $7\frac{1}{2}$	$6\frac{2}{3}$ $9\frac{5}{6}$ $8\frac{1}{2}$

CHANGING FRACTIONS TO DECIMALS



There are two ways of finding the sum of the fractions $\frac{1}{2} + \frac{1}{5} + \frac{1}{10}$. You can see that their common denominator is 10.

As Fractions	As Decimals	
$\frac{1}{2} = \frac{5}{10}$	$\frac{1}{2} = .5$	Does $\frac{5}{10} = .5$?
$\frac{1}{5} = \frac{2}{10}$	$\frac{1}{5} = .2$	Does $\frac{1}{5} = .2$?
$\frac{1}{10} = \frac{1}{10}$	$\frac{1}{10} = .1$	Are the two sums
$\frac{8}{10}$	$.8$	equal?

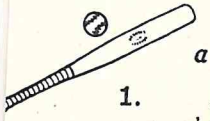
Find the sums of these numbers using the two methods shown above:

1. $\frac{1}{2} + \frac{2}{5} + \frac{3}{10} =$
2. $\frac{1}{2} + \frac{1}{5} + \frac{4}{10} =$
3. $\frac{1}{2} + \frac{3}{5} + \frac{7}{10} =$
4. $3\frac{1}{2} + 1\frac{2}{5} + 3\frac{1}{10} =$
5. $6\frac{4}{5} + 7\frac{1}{2} + 9\frac{3}{10} =$
6. $6\frac{2}{5} + 9\frac{1}{2} + 8\frac{9}{10} =$
7. How can you change the fraction $\frac{7}{25}$ to hundredths?

   THINK: $\frac{7}{25} = \frac{7 \times 4}{25 \times 4} = \frac{28}{100}$

   Express $\frac{28}{100}$ as a decimal.
8. Change the denominators of these fractions to 100. Then write them as decimals.

   a. $\frac{9}{25}, \frac{16}{25}, \frac{8}{25}, \frac{5}{25}, \frac{2}{25}, \frac{1}{25}, \frac{24}{25}$ *b.* $\frac{7}{50}, \frac{18}{50}, \frac{1}{2}, \frac{1}{10}, \frac{7}{20}, \frac{1}{4}, \frac{2}{5}$



LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	$3\frac{1}{2}$ $+2\frac{1}{4}$	25 $\times 30$	$60\overline{)247}$	$2\frac{3}{4}$ $+4\frac{7}{8}$	$8\overline{)405}$
2.	3.75 -1.42	$5\frac{1}{4}$ -2	974 $\times 58$	$24\overline{)5760}$	8 $-3\frac{1}{2}$
3.	$6\frac{2}{3}$ $+8\frac{2}{3}$	3.8 $+2567.8$	$4\frac{1}{4}$ $-2\frac{3}{4}$	Reduce $\frac{18}{24}$	$46\overline{)23184}$

4. $3.7 + 25.9 + .6 + 278.4 = ?$

*ANOTHER WAY TO FIND A COMMON DENOMINATOR

Sometimes you must add three or more fractions when none of the denominators is a common denominator. The work below explains how to find a common denominator when adding $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{5}$.

$\frac{1}{2} = \frac{10}{20}$
$\frac{1}{4} = \frac{5}{20}$
$\frac{1}{5} = \frac{4}{20}$
$\frac{19}{20}$

Begin with 5, the largest denominator. Try 2 $\times$ 5, or 10, as a denominator. 10 will contain 2 and 5, but not 4. Try 3 $\times$ 5, or 15, as a denominator. But 15 will not contain 2 or 4. Try 4 $\times$ 5, or 20, as a denominator. 20 is correct, since it will contain all three denominators.

To find the denominator of three or more unlike fractions, begin with the largest of the given denominators. If the largest denominator will contain all of the denominators, use it as the common denominator. If not, multiply the largest denominator by 2, then by 3, 4, 5, and so on until you find a number that will contain all of the denominators without a remainder. Use this denominator as the common denominator.

1. Use the above method to find common denominators for the following groups of fractions:

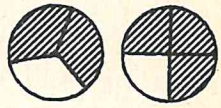
a. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}$ *b.* $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}$ *c.* $\frac{1}{2}, \frac{1}{3}, \frac{1}{5}$ *d.* $\frac{1}{4}, \frac{1}{8}, \frac{1}{10}$

Find the sums of the following:

	a	*b*	*c*
2.	$\frac{1}{2} + \frac{1}{3} + \frac{1}{4} =$	$\frac{1}{2} + \frac{1}{4} + \frac{1}{6} =$	$\frac{1}{2} + \frac{2}{3} + \frac{3}{4} =$
3.	$\frac{1}{2} + \frac{1}{3} + \frac{1}{5} =$	$\frac{1}{4} + \frac{1}{8} + \frac{1}{10} =$	$\frac{1}{2} + \frac{2}{5} + \frac{1}{4} =$
4.	$\frac{7}{8} + \frac{5}{6} + \frac{2}{3} =$	$\frac{3}{4} + \frac{5}{6} + \frac{7}{8} =$	$\frac{1}{2} + \frac{1}{5} + \frac{1}{10} =$
5.	$3\frac{1}{3} + 2\frac{1}{2} + 6\frac{1}{8} =$	$1\frac{1}{4} + 1\frac{1}{2} + 1\frac{2}{3} =$	$2\frac{1}{2} + 4\frac{1}{4} + 6\frac{1}{5} =$
6.	$9\frac{5}{6} + 6\frac{3}{4} + 5\frac{1}{2} =$	$8\frac{1}{2} + 7\frac{5}{6} + 9\frac{7}{8} =$	$7\frac{3}{5} + 6\frac{3}{4} + 2\frac{1}{2} =$
7.	$6\frac{1}{2} + 2\frac{2}{5} + 3\frac{7}{10} =$	$7\frac{1}{4} + 6\frac{5}{8} + 3\frac{3}{8} =$	$9\frac{2}{3} + 6\frac{3}{4} + 7\frac{7}{8} =$

FINDING WHICH FRACTION IS LARGEST

1. On a test over half of the children of a class missed the problem, "Which is more, $\frac{2}{3}$ or $\frac{3}{4}$?" Can you show which is more?



An easy way to compare the size of two unlike fractions is to change them to the same denominator, like this:

$$\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12} \quad \frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12} \quad \frac{9}{12} \text{ is more than } \frac{8}{12}$$

Therefore $\frac{3}{4}$ is more than $\frac{2}{3}$.

2. Which is more, $\frac{3}{4}$ or $\frac{5}{6}$?

THINK: To compare them I must change them to a common denominator. I can use either 24 (4×6), or 12.

3. Which is more, $\frac{3}{4}$ or $\frac{7}{8}$?

THINK: Change both to eighths.

4. Which is more, $\frac{1}{3}$ or $\frac{5}{12}$? $\frac{5}{6}$ or $\frac{7}{8}$? $\frac{1}{2}$ or $\frac{1}{3}$?

5. Which fraction is largest, $\frac{2}{3}$, $\frac{3}{5}$, or $\frac{7}{10}$?

6. Which fraction is smallest, $\frac{3}{4}$, $\frac{5}{6}$, or $\frac{7}{8}$?

Arrange these fractions in the order of their value, placing the fraction of largest value first:

7. $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{6}$

8. $\frac{5}{6}$, $\frac{2}{3}$, $\frac{4}{5}$

9. $\frac{7}{10}$, $\frac{1}{2}$, $\frac{3}{5}$

10. $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{5}$

11. $\frac{4}{5}$, $\frac{7}{8}$, $\frac{3}{4}$

12. $\frac{2}{3}$, $\frac{5}{6}$, $\frac{7}{9}$

13. Which is more, \$.25 or $\frac{1}{2}$ dollar?

14. Which is most, \$1.25, \$2, or $1\frac{1}{10}$ dollars?

15. Which is more, $\frac{3}{4}$ pound or $\frac{7}{8}$ pound?

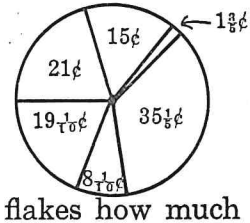
16. Which is less, $\frac{3}{8}$ foot or $\frac{1}{4}$ foot?

WHAT THE PRICE OF FOOD INCLUDES

Whenever you go to the store and buy food, the price you pay includes a number of charges for producing, manufacturing, and distributing the food. For example, each dollar you spend for corn flakes is distributed as follows:

	Corn Flakes
Farmer	21 ¢
Transportation	15 ¢
Storage in Elevator	$1\frac{3}{5}$ ¢
Manufacturer	$35\frac{1}{5}$ ¢
Wholesaler	$8\frac{1}{10}$ ¢
Retail Dealer	$19\frac{1}{10}$ ¢

The Corn Flake Dollar



1. Of each dollar you spend for corn flakes how much does the farmer receive? the manufacturer? the retailer?

2. Find by addition if the total of the charges for corn flakes is a dollar.

3. The corn flake dollar at the right tells the story in a different way. Match the names in the left-hand column with the correct part of the corn flake dollar.

4. How much more does the farmer receive of each dollar spent for corn flakes than the retail dealer receives? Do you think he should receive more? Why?

5. How much more does the farmer receive of each dollar you spend for corn flakes than the wholesaler receives?

6. How much more than the farmer receives does the manufacturer receive of each dollar you spend for corn flakes?

*7. What are some of the items that must be paid for by the farmer out of his share of each dollar you spend for corn flakes? by the manufacturer? by the retailer?

THINGS TO REMEMBER ABOUT ADDING FRACTIONS

1. Fractions must have the same denominator before they can be added. How do you find a common denominator?

2. Be sure to add the numerators of like fractions and to write the sum over the common denominator.

3. Be sure to reduce all fractions in your answers to lowest terms.

4. Never leave an improper fraction in your answer.

5. Always express your answer in simplest form. How do you change $5\frac{6}{4}$ to simplest form?

6. Always go over your work to find any mistakes in computation and any other careless work.

PRACTICE IN ADDING FRACTIONS

The examples below are some of the most difficult ones found in a test given to a large number of sixth-grade children. How many of them can you work correctly? Do your work carefully and go over your work to find any careless mistakes you may have made.

	a	*b*	*c*	*d*	*e*	*f*
1.	$5\frac{5}{6}$ $2\frac{5}{6}$	$\frac{7}{12}$ $\frac{3}{4}$	$2\frac{2}{3}$ $7\frac{5}{6}$	$\frac{5}{12}$ $1\frac{1}{3}$	$3\frac{3}{5}$ $2\frac{4}{5}$	$1\frac{1}{4}$ $3\frac{7}{12}$
2.	$7\frac{3}{5}$ $5\frac{2}{4}$	$1\frac{1}{6}$ $7\frac{2}{5}$ $3\frac{1}{6}$	$\frac{1}{3}$ $\frac{1}{5}$ $\frac{1}{10}$	$\frac{3}{4}$ $\frac{1}{6}$ $\frac{1}{8}$	$6\frac{3}{4}$ $4\frac{2}{3}$	$3\frac{17}{24}$ $4\frac{5}{6}$ $3\frac{5}{8}$
3.	$3\frac{1}{4}$ $7\frac{1}{2}$ $6\frac{3}{8}$	$9\frac{3}{4}$ $6\frac{1}{2}$ $7\frac{3}{4}$	$3\frac{1}{4}$ $4\frac{1}{6}$ $9\frac{1}{8}$	$4\frac{1}{2}$ $2\frac{3}{5}$ $7\frac{7}{10}$	$6\frac{1}{4}$ $2\frac{1}{3}$ $9\frac{1}{2}$	$4\frac{5}{6}$ $6\frac{2}{3}$ $8\frac{1}{2}$

Did you make any errors in working these examples? What were the errors you made?

FINDING REASONS FOR YOUR ERRORS

In the examples below there are given the nine kinds of errors that we know boys and girls make most frequently in addition of fractions. Study each example and tell what the error is. Then work the example correctly. Do you ever make these kinds of errors? Do you make other kinds of errors?

1. $4\frac{1}{4}$
   $2\frac{1}{4}$
   $6\frac{2}{4}$

2. $8\frac{1}{8}$
   $5\frac{7}{8}$
   $13\frac{8}{8} = 1$

3. $9\frac{3}{4}$
   $\frac{3}{4}$
   $9\frac{6}{4}$

4. $2\frac{1}{2} = \frac{2}{4}$
   $3\frac{1}{4} = \frac{1}{4}$
   $\frac{3}{4}$

5. $\frac{3}{8}$
   $\frac{1}{4}$
   $\frac{4}{8} = \frac{1}{2}$

6. $7\frac{1}{3}$
   8
   14

7. $\frac{3}{4} + \frac{1}{2} = \frac{4}{6} = \frac{2}{3}$

8. $\frac{3}{4} + \frac{1}{2} = \frac{4}{8} = \frac{1}{2}$

9. $\frac{7}{8} = \frac{7}{8}$
   $\frac{3}{4} = \frac{6}{8}$
   $\frac{13}{8} = 1\frac{3}{8}$

PRACTICE IN FINDING REASONS FOR ERRORS

Work the examples below carefully. After your paper has been marked, go over your work and make a list of errors you made and correct your mistakes. From now on try not to repeat the kinds of errors you made.

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	$\frac{1}{8}$ $\frac{1}{8}$	3 $2\frac{1}{4}$	$\frac{1}{3}$ $\frac{2}{3}$	$7\frac{1}{4}$ $\frac{1}{4}$	$\frac{1}{4}$ $\frac{1}{2}$	$3\frac{1}{8}$ $\frac{1}{4}$	$7\frac{2}{3}$ $6\frac{1}{5}$
2.	$7\frac{3}{4}$ $5\frac{3}{4}$	$6\frac{2}{3}$ $\frac{2}{3}$	$3\frac{3}{8}$ $2\frac{3}{4}$	$\frac{1}{5}$ $\frac{3}{4}$	$\frac{2}{3}$ $\frac{1}{6}$	$\frac{7}{8}$ $\frac{3}{4}$	$\frac{3}{8}$ $\frac{5}{6}$
3.	$\frac{2}{3}$ $\frac{5}{6}$	$3\frac{7}{8}$ $2\frac{1}{2}$	$6\frac{1}{2}$ $\frac{7}{8}$	$7\frac{3}{8}$ $5\frac{3}{4}$	$6\frac{3}{4}$ $\frac{1}{4}$	$7\frac{1}{2}$ $9\frac{1}{2}$	$6\frac{1}{2}$ $\frac{2}{3}$

Always go over your work to find careless errors.

WE USE FRACTIONS IN MANY WAYS

Here are some problems made by boys and girls, showing how they use fractions.

1. Jack: "I sell newspapers. I sell them for 5 cents each and pay $3\frac{1}{2}$ cents for them. How much more than I pay for a paper do I receive for it?"

2. May: "I had a ribbon $3\frac{3}{4}$ yards long. I cut off a piece $1\frac{1}{4}$ yards long. How long was the piece that was left?"

3. Tom: "I am making a kennel for my dog. I have a board 10 feet long. If I cut it into 4 equal pieces, how long will each piece be?"

4. Melvin: "Tom can run 50 yards in $8\frac{3}{5}$ seconds. It takes Bob 9 seconds to run 50 yards. In how much less time than it takes Bob can Tom run 50 yards?"

5. Mary: "We have 6 new puppies. Four of them are black. What part of the total number of puppies is not black?"

6. Ruth: "We baked two cakes yesterday. For one cake we used $\frac{1}{4}$ pound of butter, for the other $\frac{1}{2}$ pound. How much butter did we use for the two cakes?"

7. Bob: "It takes an airplane $3\frac{3}{4}$ hours to make the trip from here to Chicago. It takes a fast train $9\frac{1}{4}$ hours to make the trip. How much less time does it take the airplane than the train?"

8. Grace: "My father says that our farm is $\frac{3}{4}$ mile long and $\frac{3}{8}$ mile wide. If I walk around the outside of the farm, how far do I walk?"

*9. Make up a problem showing how you use fractions.

DIAGNOSTIC TEST IN ADDING UNLIKE FRACTIONS

If you make only one or two errors in a row of examples, correct your work at once. If you make errors in more than two examples in a row, study again the work on the page shown in heavy type. Then rework the row of examples.

	a	*b*	*c*	*d*	*e*	*f*	
1.	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{4}$ $\frac{1}{8}$	$\frac{1}{2}$ $\frac{1}{8}$	$\frac{3}{8}$ $\frac{3}{4}$	$\frac{5}{8}$ $\frac{1}{2}$	$\frac{1}{3}$ $\frac{5}{6}$	(107)
2.	$2\frac{1}{2}$ $3\frac{1}{4}$	$2\frac{1}{3}$ $3\frac{1}{6}$	$4\frac{1}{4}$ $5\frac{3}{8}$	$7\frac{3}{8}$ $5\frac{1}{2}$	$6\frac{1}{2}$ $\frac{5}{6}$	$\frac{3}{4}$ $8\frac{1}{8}$	(113)
3.	$4\frac{3}{4}$ $2\frac{1}{2}$	$4\frac{1}{2}$ $6\frac{7}{8}$	$8\frac{3}{4}$ $5\frac{5}{8}$	$6\frac{1}{2}$ $3\frac{5}{6}$	$4\frac{2}{3}$ $\frac{5}{6}$	$\frac{5}{6}$ $8\frac{1}{2}$	(114)
4.	$\frac{1}{2}$ $\frac{1}{3}$	$\frac{1}{3}$ $\frac{1}{4}$	$\frac{2}{3}$ $\frac{1}{5}$	$\frac{1}{2}$ $\frac{3}{5}$	$\frac{3}{6}$ $\frac{3}{8}$	$\frac{3}{4}$ $\frac{5}{6}$	(121)
5.	$2\frac{1}{4}$ $3\frac{1}{3}$	$5\frac{1}{2}$ $6\frac{2}{5}$	$7\frac{3}{4}$ $2\frac{1}{5}$	$6\frac{7}{8}$ $2\frac{1}{6}$	$3\frac{3}{4}$ $\frac{5}{6}$	$\frac{2}{3}$ $3\frac{3}{5}$	(121)

6. Find the sum of $3\frac{1}{3} + 2\frac{1}{4} + 1\frac{3}{5}$. (124)

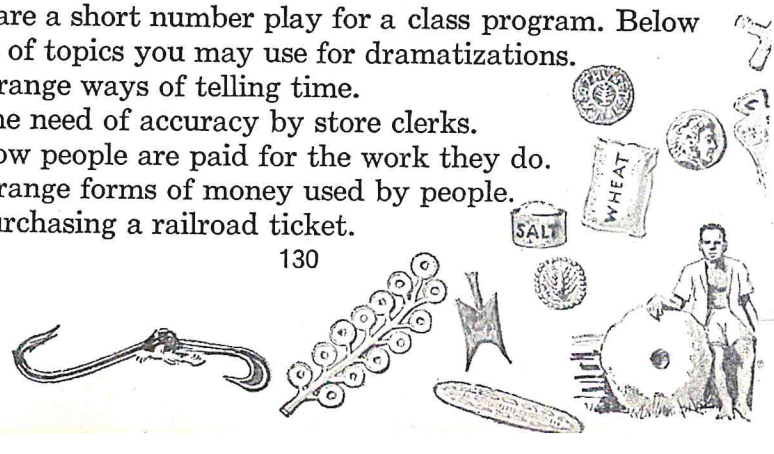
Make a list of the examples you worked incorrectly and beside each of these examples write the reason for your mistake. Did you make any kind of error more than once?

Repeat the test in addition of like fractions on page 22.

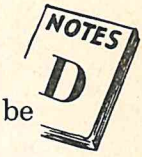
*DRAMATIZING USES OF NUMBERS IN DAILY LIFE

Prepare a short number play for a class program. Below is a list of topics you may use for dramatizations.

1. Strange ways of telling time.
2. The need of accuracy by store clerks.
3. How people are paid for the work they do.
4. Strange forms of money used by people.
5. Purchasing a railroad ticket.



HOW WELL DO YOU REMEMBER?



1. Write two pairs of unlike fractions on your paper.

2. What must be done before two unlike fractions can be added?

3. Tell how to find the common denominators of these fractions. Then find their sums:

a. $\frac{1}{2}$ / $\frac{3}{4}$ *b.* $\frac{2}{3}$ / $\frac{3}{4}$ *c.* $\frac{5}{6}$ / $\frac{3}{8}$ *d.* $\frac{4}{5}$ / $\frac{1}{6}$

4. To what denominator would you change the fractions below to find their sums?

a. $\frac{1}{2}, \frac{3}{4}, \frac{7}{8}$ *b.* $\frac{1}{2}, \frac{2}{3}, \frac{5}{6}$ *c.* $\frac{1}{3}, \frac{1}{4}, \frac{2}{5}$ *d.* $\frac{1}{4}, \frac{1}{6}, \frac{1}{8}$

5. Find the sums of the fractions in 4.

6. Arrange these fractions in order of their size, placing the fraction of largest value first.

a. $\frac{1}{2}, \frac{3}{4}, \frac{5}{8}$ *b.* $\frac{1}{2}, \frac{5}{6}, \frac{2}{3}$ *c.* $\frac{3}{4}, \frac{5}{8}, \frac{5}{6}$ *d.* $\frac{3}{5}, \frac{1}{2}, \frac{3}{10}$

INFORMATION PLEASE!

1. What unit of measure is best used to describe the area of a state?

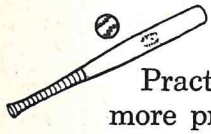
2. What is the difference between a picture graph and a bar graph?

3. What do we mean by saying that a man has credit at a store?

4. How does the United States Weather Bureau use arithmetic in preparing weather maps?

5. How can you find the signature of a piece of music?

6. State why the zero is such an important figure in our number system.



LET'S PRACTICE

Practice one set of these examples a day. If you need more practice, work the same set of examples on several days. Keep a record of your scores for each trial to see how your work improves.

Set I

1. $\begin{array}{r} 9875 \\ 675 \\ 8492 \\ 7864 \\ 895 \\ 76 \\ \hline \end{array}$

2. $\begin{array}{r} 98.753 \\ -85.004 \\ \hline \end{array}$

3. $\begin{array}{r} 18\frac{3}{4} \\ +29\frac{3}{4} \\ \hline \end{array}$

4. $\begin{array}{r} 19\frac{1}{4} \\ -4\frac{3}{4} \\ \hline \end{array}$

5. $\begin{array}{r} 984 \\ \times 800 \\ \hline \end{array}$

6. $\frac{1}{4}$ of 816 =

7. $56\overline{)5244}$

8. $\begin{array}{r} 95\frac{7}{8} \\ +16\frac{1}{2} \\ \hline \end{array}$

9. $36\overline{)1728}$

10. $\begin{array}{r} \$4.67 \\ \times 95 \\ \hline \end{array}$

Set II

1. $\begin{array}{r} 954.7 \\ 903.0 \\ 9.5 \\ 89.5 \\ 587.9 \\ 89.6 \\ \hline \end{array}$

2. $\begin{array}{r} 276.3 \\ -48.5 \\ \hline \end{array}$

3. $\begin{array}{r} 16\frac{1}{2} \\ +9\frac{1}{4} \\ \hline \end{array}$

4. $\begin{array}{r} 7 \\ -2\frac{7}{8} \\ \hline \end{array}$

5. $\begin{array}{r} 753 \\ \times 708 \\ \hline \end{array}$

6. $\frac{1}{8}$ of 960 =

7. $89\overline{)8036}$

8. $\begin{array}{r} 38\frac{1}{2} \\ +47\frac{1}{2} \\ \hline \end{array}$

9. $49\overline{)3375}$

10. $\begin{array}{r} 625 \\ \times 460 \\ \hline \end{array}$

USING THE VOCABULARY OF ARITHMETIC

Give sentences showing how we use these words in arithmetic.

reduction	average	square yard	temperature
rows	record	weight	unlike fractions
total	thousandth	carat	diagnostic test
mixed number	account	denominator	cash register

MEASURING GROWTH IN PROBLEM SOLVING

1. George is $57\frac{3}{4}$ inches tall. Anna is $52\frac{1}{4}$ inches tall. How much taller than Anna is George?

2. If butter costs 40 cents a pound, how much can you buy for 60 cents?

3. A train travels 252 miles in 7 hours. How far does it travel in an hour?

4. Dick can run 60 yards in 8.5 seconds and 100 yards in 16.2 seconds. How much longer does it take him to run 100 yards than to run 60 yards?

5. At a $\frac{1}{3}$-off sale Mary's mother bought some cloth, the regular price of which was 75 cents a yard. How much did she pay a yard for the cloth?

6. What part of a pound is 12 ounces?

7. It is $\frac{1}{2}$ mile from Harry's home to the school, $\frac{1}{4}$ mile beyond the school to the lake, and $\frac{1}{8}$ mile farther to the bathing beach. How far is it from Harry's home to the bathing beach?

8. On a 10-acre field Mr. Smith raised 140 bushels of wheat. How much did he receive for the wheat raised on an acre if he sold the wheat for \$.96 a bushel?

9. A carpenter has a board 10 feet long. He cuts off two pieces, one $3\frac{1}{2}$ feet long, the other $2\frac{3}{4}$ feet long. How long is the piece of board that is left?

10. Bob bought $\frac{1}{2}$ pound of butter at 42 cents a pound and $\frac{1}{4}$ pound of bacon at 36 cents a pound. How much change should he receive from a half dollar?

What Your Score Means

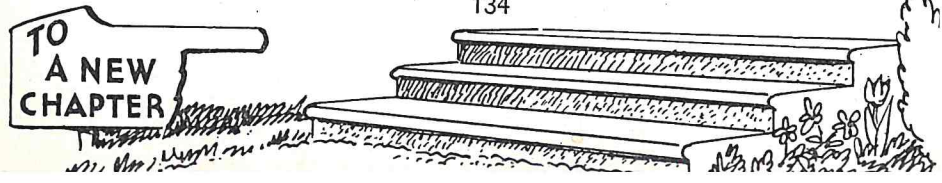
Unsatisfactory	Fair	Good	Excellent
0 1 2 3 4	5 6	7 8	9 10

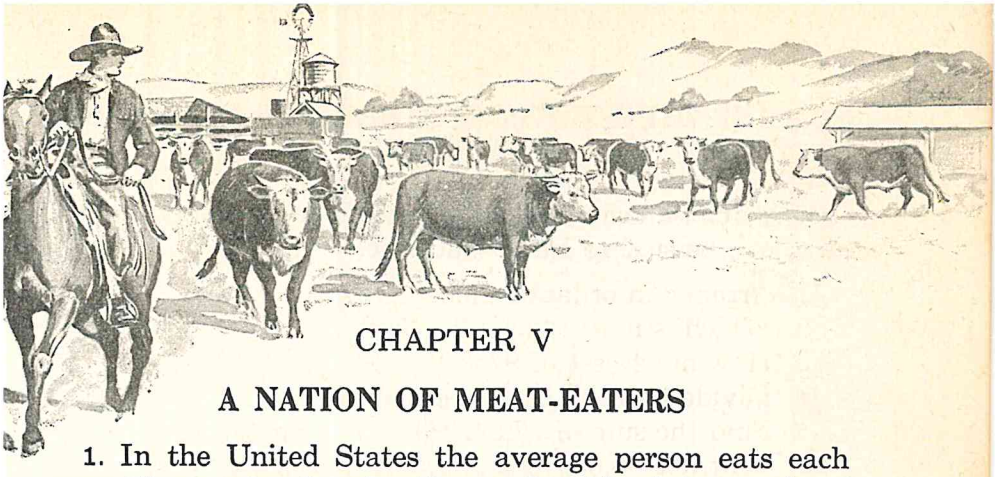
UP THE STEPS TO A NEW CHAPTER

This test will help you to find out how well you know the arithmetic that you have studied. When you copy the numbers, be sure to leave enough space for your work.

1. Arrange in order of their size: $\frac{1}{2}$, $\frac{5}{8}$, $\frac{1}{3}$, $\frac{3}{4}$. (125)
2. Which is most, .39, .195, .4, or .298? (45)
3. How much is $\frac{1}{5}$ of 975? (11)
4. Divide 4368 by 84. Check your answer. (17)
5. Find the sum of 27.64, 1.08, .90, and 149.32. (42)
6. Subtract 38.679 from 47.521. Check by addition. (49)
7. How much is 450 $\times$ 397? (59)
8. Find the product of 879 $\times$ 948. (58)
9. Find the product of 600 $\times$ \$6.75. (57)
10. 4042 $\div$ 46 = ? Check your answer. (77)
11. How much is 29640 $\div$ 38? (88)
12. Divide 10872 by 18. Check your answer. (96)
13. Supply the missing numerators: $1\frac{3}{8} = \frac{?}{8}$; $4\frac{3}{4} = 3\frac{?}{4}$; $5 = 4\frac{?}{2}$. (23)
14. Express in simplest form: $9\frac{6}{2}$; $7\frac{12}{8}$; $6\frac{3}{3}$. (23)
15. How much is $9\frac{3}{4} + 8\frac{1}{4} + 14\frac{1}{4}$? (26)
16. How much less than 18 is $9\frac{5}{8}$? (28)
17. Subtract $29\frac{3}{4}$ from $48\frac{1}{4}$. Check by addition. (29)
18. Supply the missing numerators: $\frac{3}{4} = \frac{?}{16}$; $\frac{1}{3} = \frac{?}{12}$; $\frac{5}{6} = \frac{?}{24}$. (117)
19. Add these numbers: $2\frac{1}{2} + 4\frac{3}{4}$ = ? (114)
20. Find the sum of $3\frac{1}{2}$, $2\frac{1}{3}$, and $6\frac{5}{6}$. (118)

After your test has been marked, correct at once any errors you may have made. If necessary, turn for help to the pages given at the right of the test. Do not go on to the next chapter until you can work correctly every example in the test.





CHAPTER V

A NATION OF MEAT-EATERS

1. In the United States the average person eats each year 70 pounds of pork, 48 pounds of beef, 7 pounds of veal, and 7 pounds of lamb. About how many pounds of meat does each person eat?

2. A large hog after being butchered weighs about 210 pounds. This is enough pork for about how many people?

3. The United States produces $\frac{1}{3}$ of the world's pork supply. What part do other countries produce?

4. The farmers of our corn states, Iowa, Illinois, Indiana, Ohio, Nebraska, Kansas, and Missouri produce $\frac{2}{3}$ of all of our hogs. What part is produced by other states?

5. A steer that weighs 1000 pounds gives about 560 pounds of beef. This is enough beef for about how many people?

6. One fourth of this 560 pounds of beef makes fine steaks and choice cuts. The rest is used for pot roasts, round steak, and other cuts. How many pounds of a 1000-pound steer are used for steaks and choice cuts?

7. At a certain meat market sirloin steak costs 59 cents a pound. Pot roast costs only 32 cents a pound. How much more do 5 pounds of sirloin steak cost than 5 pounds of pot roast?

*8. Why are the prices not the same for the different kinds of meat we get from hogs, cattle, and sheep?

READINESS TEST FOR SUBTRACTION OF UNLIKE FRACTIONS

This test will help you to find out if you are ready for the work in subtracting unlike fractions.

I. Subtract these numbers:

1. $\frac{3}{4}$ / $\frac{1}{4}$
2. $3\frac{1}{2}$ / $\frac{1}{2}$
3. $4\frac{1}{4}$ / $2\frac{3}{4}$
4. 9 / $2\frac{1}{2}$
5. $7\frac{2}{3}$ / $5\frac{1}{3}$
6. $1\frac{1}{8}$ / $\frac{5}{8}$

II. Find the missing numerators:

1. $\frac{1}{2} = \frac{?}{4}$
2. $\frac{3}{4} = \frac{?}{8}$
3. $\frac{2}{3} = \frac{?}{6}$
4. $1\frac{1}{3} = 1\frac{?}{6}$
5. $8\frac{1}{2} = 8\frac{?}{8}$
6. $7\frac{3}{4} = 7\frac{?}{8}$
7. $1\frac{1}{2} = 1\frac{?}{4} = \frac{?}{4}$
8. $7\frac{3}{4} = 7\frac{?}{8} = 6\frac{?}{8}$
9. $9\frac{1}{3} = 9\frac{?}{6} = 8\frac{?}{6}$

III. Find the sums of these numbers:

1. $2\frac{1}{2}$ / $3\frac{1}{4}$
2. $9\frac{5}{6}$ / $6\frac{1}{2}$
3. $8\frac{3}{8}$ / $9\frac{1}{4}$
4. $6\frac{3}{4}$ / $7\frac{1}{6}$
5. $9\frac{1}{2}$ / $7\frac{1}{3}$
6. $6\frac{4}{5}$ / $7\frac{3}{10}$

IV. Express these numbers in simplest form:

a. $5\frac{2}{4}$ *b.* $6\frac{4}{6}$ *c.* $8\frac{6}{8}$ *d.* $7\frac{3}{3}$ *e.* $8\frac{2}{2}$ *f.* $9\frac{12}{16}$

V. Which is more?

a. $\frac{3}{4}$ or $\frac{1}{2}$ *b.* $6\frac{3}{8}$ or $5\frac{1}{2}$ *c.* $9\frac{2}{3}$ or $9\frac{3}{4}$ *d.* $7\frac{5}{8}$ or $7\frac{4}{6}$

VI. Subtract these numbers if you can:

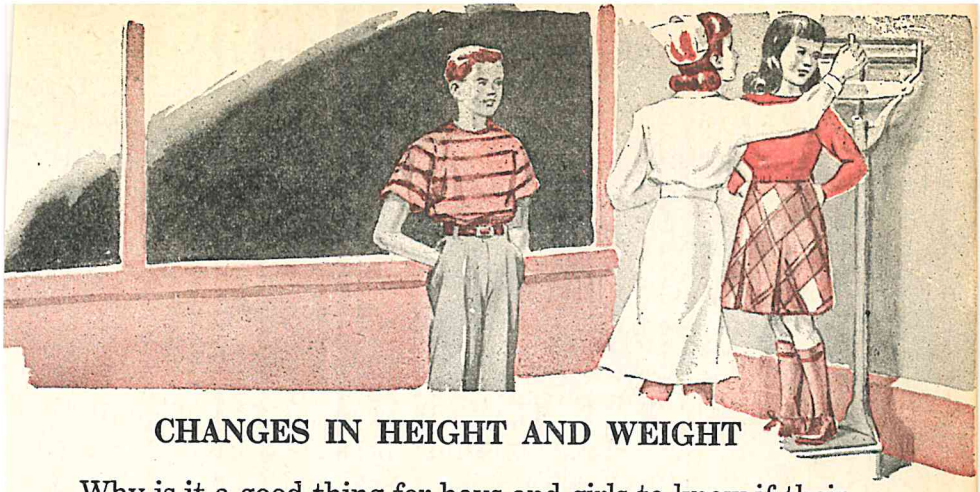
1. $\frac{3}{4}$ / $\frac{1}{8}$
2. $\frac{1}{2}$ / $\frac{1}{4}$
3. $5\frac{3}{4}$ / $3\frac{1}{2}$
4. $8\frac{2}{3}$ / $4\frac{1}{2}$
5. $9\frac{5}{6}$ / $7\frac{1}{3}$
6. $6\frac{1}{4}$ / $5\frac{1}{2}$

THINGS TO REMEMBER

1. What must you do before you can add two fractions that do not have the same denominator? This is also true of subtracting fractions.

2. How can you find a common denominator for two unlike fractions, such as $\frac{1}{2}$ and $\frac{1}{6}$? $\frac{1}{2}$ and $\frac{1}{3}$? $\frac{1}{4}$ and $\frac{1}{6}$?

3. What is the remainder when you subtract $2\frac{3}{4}$ from $3\frac{1}{4}$? Watch the zeros when subtracting fractions and mixed numbers.



CHANGES IN HEIGHT AND WEIGHT

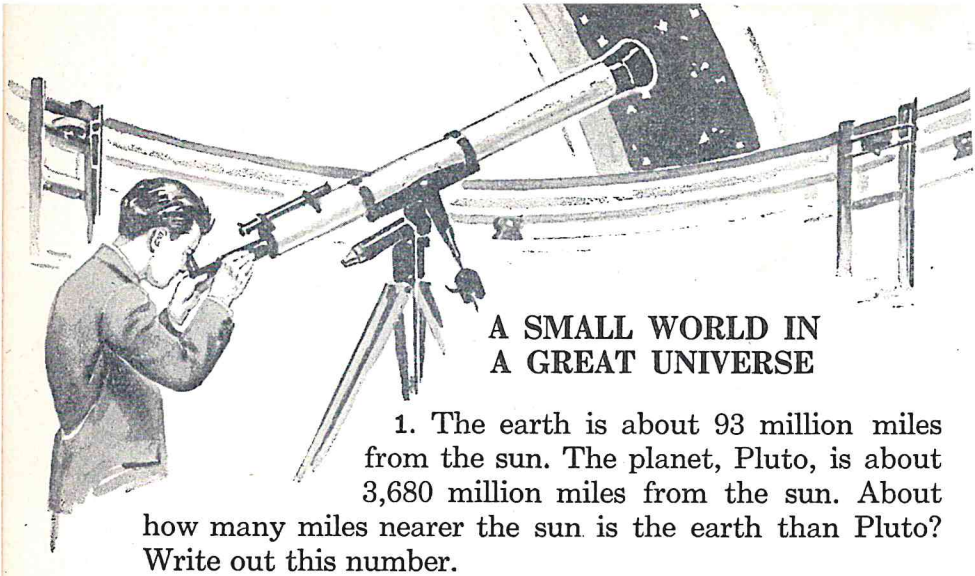
Why is it a good thing for boys and girls to know if their weight is normal for children of their age and height?

Here are given the height and weight of three children, all of them 11 years of age. The measurements are for September when school began and for the following May.

	Tom Jones		Grace Smith		George Jackson	
	Height	Weight	Height	Weight	Height	Weight
September	58 in.	$84\frac{1}{2}$ lb.	$54\frac{1}{2}$ in.	$74\frac{3}{4}$ lb.	$57\frac{1}{2}$ in.	$90\frac{1}{4}$ lb.
May	$59\frac{1}{4}$ in.	86 lb.	55 in.	$72\frac{1}{4}$ lb.	$58\frac{1}{2}$ in.	$94\frac{3}{4}$ lb.

1. What was Tom's height in September? in May?
2. How much did his height increase from September to May?
3. What was Tom's weight in September? in May?
4. Did all of the children increase in height? in weight?
5. Which child gained most in height? How much?
6. Which child gained most in weight? How much?
7. How much did Grace lose in weight?

*8. Keep a record of your weight and height at the end of each month from now until the close of the school year to see how your measurements change. Consult a standard height-weight chart to see if your weight is normal for your height and age.



A SMALL WORLD IN A GREAT UNIVERSE

1. The earth is about 93 million miles from the sun. The planet, Pluto, is about 3,680 million miles from the sun. About how many miles nearer the sun is the earth than Pluto? Write out this number.

2. The diameter (distance through the center) of Jupiter, the largest planet, is about 88,000 miles. The diameter of the earth is about 8,000 miles. About how many times as much as the diameter of the earth is the diameter of Jupiter?

3. Jupiter is about 473 million miles from the sun. It takes light from the sun about 43 minutes to reach Jupiter. How many miles does light travel in one minute?

4. How many hours would it take a train traveling at an average rate of 55 miles an hour to travel the distance light travels in one minute?

5. The highest mountain is about $5\frac{1}{2}$ miles high. The highest airplane flight up to a recent year was about $10\frac{1}{2}$ miles. How much higher than the top of the highest mountain did the plane fly?

6. The highest passenger balloon flight ever made was about 15 miles high. How much higher was this than the highest airplane flight?

*7. Where are some of the large telescopes located that are used to study the stars and planets? How is a telescope different from a microscope?

SUBTRACTING UNLIKE FRACTIONS

1. Alice had $\frac{3}{4}$ glass of orange juice. She drank $\frac{1}{2}$ glassful. How much orange juice was left?

$\frac{3}{4} = \frac{3}{4}$

$-\frac{1}{2} = \frac{2}{4}$

$\frac{1}{4}$

THINK: $\frac{3}{4} - \frac{1}{2} = ?$

Before unlike fractions can be subtracted, they must be changed to like fractions.

Change $\frac{1}{2}$ to $\frac{2}{4}$, then subtract.

There was $\frac{1}{4}$ glassful left.

2. Study the work below carefully. Then copy, and work the examples with your book closed.

a. $\frac{7}{8} = \frac{7}{8}$
$-\frac{1}{2} = \frac{4}{8}$
$\frac{3}{8}$

b. $\frac{5}{6} = \frac{5}{6}$
$-\frac{1}{3} = \frac{2}{6}$
$\frac{3}{6} = \frac{1}{2}$

c. $\frac{3}{4} = \frac{6}{8}$
$-\frac{3}{8} = \frac{3}{8}$
$\frac{3}{8}$

REMEMBER: **Fractions must have the same denominator before they can be subtracted.**

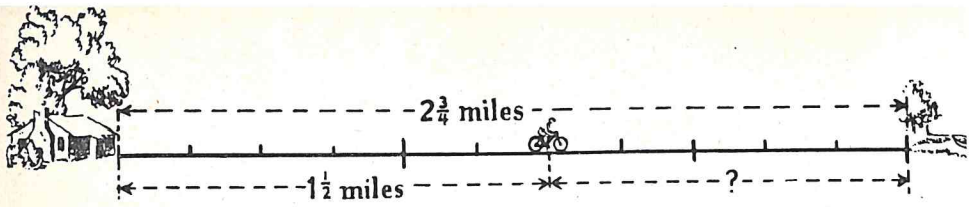
3. How much less than $\frac{7}{8}$ pound is $\frac{1}{2}$ pound?

Subtract:

	a	*b*	*c*	*d*	*e*	*f*	*g*
4.	$\frac{3}{4}$ $\frac{1}{8}$	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{2}$ $\frac{1}{8}$	$\frac{5}{8}$ $\frac{1}{4}$	$\frac{5}{6}$ $\frac{2}{3}$	$\frac{7}{8}$ $\frac{3}{4}$	$\frac{5}{8}$ $\frac{1}{2}$
5.	$\frac{7}{8}$ $\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{6}$	$\frac{2}{3}$ $\frac{1}{6}$	$\frac{5}{6}$ $\frac{1}{2}$	$\frac{3}{4}$ $\frac{1}{2}$	$\frac{1}{2}$ $\frac{1}{3}$	$\frac{3}{4}$ $\frac{5}{8}$
6.	$\frac{1}{2}$ $\frac{3}{8}$	$\frac{5}{6}$ $\frac{1}{3}$	$\frac{7}{8}$ $\frac{1}{4}$	$\frac{1}{3}$ $\frac{1}{6}$	$\frac{5}{6}$ $\frac{2}{3}$	$\frac{3}{4}$ $\frac{3}{8}$	$\frac{2}{3}$ $\frac{1}{2}$

MIXED PRACTICE IN SUBTRACTING FRACTIONS

1.	1 $\frac{1}{2}$	$\frac{3}{4}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{8}$	$4\frac{7}{8}$ $\frac{3}{8}$	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{1}{8}$ $\frac{1}{8}$	$\frac{7}{8}$ $\frac{3}{4}$
2.	2 $1\frac{1}{2}$	$\frac{5}{6}$ $\frac{1}{2}$	$4\frac{2}{3}$ $\frac{1}{3}$	$\frac{3}{4}$ $\frac{1}{2}$	$6\frac{1}{4}$ $2\frac{3}{4}$	$\frac{5}{8}$ $\frac{1}{2}$	$5\frac{1}{2}$ $2\frac{1}{2}$



SUBTRACTING MIXED NUMBERS CONTAINING UNLIKE FRACTIONS

1. John lives $2\frac{3}{4}$ miles from the lake. After he has ridden $1\frac{1}{2}$ miles toward the lake, how much farther must he ride?

THINK: $2\frac{3}{4} - 1\frac{1}{2} = ?$

$$\begin{array}{rl} 2\frac{3}{4} = 2\frac{3}{4} & \text{Change } \frac{3}{4} \text{ and } \frac{1}{2} \text{ to like fractions.} \\ -1\frac{1}{2} = 1\frac{2}{4} & \text{Subtract the fractions: } \frac{3}{4} - \frac{2}{4} = \frac{1}{4}. \\ \hline 1\frac{1}{4} & \text{Subtract 1 from 2. This gives 1.} \end{array}$$

He still had to ride $1\frac{1}{4}$ miles.

2. Study the work below carefully. Then copy, and work the examples with your book closed. Be sure that you understand each step in the work.

$$\begin{array}{lll} a. \quad 8\frac{1}{2} = 8\frac{2}{4} & b. \quad 27\frac{2}{3} = 27\frac{4}{6} & c. \quad 12\frac{7}{8} = 12\frac{7}{8} \\ \underline{-6\frac{1}{4} = 6\frac{1}{4}} & \underline{-6\frac{1}{6} = 6\frac{1}{6}} & \underline{-\frac{1}{2} = \frac{4}{8}} \\ 2\frac{1}{4} & 21\frac{3}{6} = 21\frac{1}{2} & 12\frac{3}{8} \end{array}$$

Subtract:

	a	*b*	*c*	*d*	*e*	*f*
3.	$9\frac{3}{4}$	$11\frac{1}{2}$	$8\frac{3}{8}$	$9\frac{1}{2}$	$12\frac{5}{8}$	$7\frac{5}{6}$
	$\underline{4\frac{1}{2}}$	$\underline{2\frac{3}{8}}$	$\underline{3\frac{1}{4}}$	$\underline{8\frac{1}{8}}$	$\underline{3\frac{1}{4}}$	$\underline{2\frac{1}{3}}$
4.	$12\frac{1}{2}$	$8\frac{7}{8}$	$7\frac{1}{3}$	$8\frac{2}{3}$	$9\frac{5}{6}$	$13\frac{1}{2}$
	$\underline{5\frac{1}{6}}$	$\underline{6\frac{1}{4}}$	$\underline{3\frac{1}{6}}$	$\underline{4\frac{1}{6}}$	$\underline{5\frac{2}{3}}$	$\underline{7\frac{1}{3}}$
5.	$9\frac{5}{8}$	$16\frac{5}{6}$	$9\frac{1}{2}$	$7\frac{2}{3}$	$8\frac{3}{4}$	$9\frac{5}{6}$
	$\underline{7\frac{1}{2}}$	$\underline{9\frac{2}{3}}$	$\underline{6\frac{1}{4}}$	$\underline{4\frac{1}{6}}$	$\underline{5\frac{5}{8}}$	$\underline{9\frac{1}{2}}$

MIXED PRACTICE IN SUBTRACTING FRACTIONS

1.	$\frac{3}{4}$	$8\frac{2}{3}$	$\frac{7}{8}$	$\frac{3}{4}$	6	$15\frac{3}{4}$
	$\underline{\frac{1}{4}}$	$\underline{\frac{1}{6}}$	$\underline{\frac{1}{8}}$	$\underline{\frac{1}{2}}$	$\underline{5\frac{1}{2}}$	$\underline{9\frac{1}{4}}$
2.	$5\frac{1}{4}$	$\frac{5}{6}$	$14\frac{1}{4}$	$7\frac{2}{3}$	$5\frac{7}{8}$	$11\frac{1}{2}$
	$\underline{\frac{3}{4}}$	$\underline{\frac{2}{3}}$	$\underline{6}$	$\underline{\frac{2}{3}}$	$\underline{2\frac{1}{2}}$	$\underline{3\frac{1}{4}}$

EGGS FOR BREAKFAST

On three mornings a week John, Peggy, and Mother each have an egg for breakfast. Father has two eggs. John likes his eggs hard-boiled; Peggy and Mother like theirs boiled medium-hard; Father likes his soft-boiled.

1. How many eggs do they eat for breakfast in one week? Why are eggs good food?

2. In the spring of one year eggs cost 24 cents a dozen. How much did one egg cost? How much did the eggs for one week cost?

3. In December of that year the price of eggs was 48 cents a dozen. How much did the eggs for a week then cost?

4. How much did the eggs for the family for a week in December cost them if Father ate only one egg for each breakfast?

5. Father's eggs are cooked $3\frac{1}{4}$ minutes. Peggy's eggs are cooked $4\frac{1}{2}$ minutes. How much longer are Peggy's eggs cooked than Father's eggs are cooked?

6. It takes about 15 minutes to cook hard-boiled eggs. How much longer does it take to cook John's egg than to cook Peggy's egg?

*7. Show how Mother can use the second hand on a clock to tell when the eggs have been cooked long enough. What is a "sand glass"?

*8. Why are the prices for eggs almost always higher late in the fall than in the spring? Find the prices of eggs today at some store.

USING A RULER IN SUBTRACTING FRACTIONS

1. Draw a line $2\frac{1}{2}$ inches long. Cover $1\frac{1}{4}$ inches of the line with a card. Measure the part of the line that is uncovered. If you have measured correctly, you have found that $2\frac{1}{2}$ in. $-$ $1\frac{1}{4}$ in. $=$ $1\frac{1}{4}$ in. Show by subtracting the numbers that $1\frac{1}{4}$ is correct.

2. Use these two methods to show that $2\frac{3}{4}$ inches less $1\frac{1}{2}$ inches equals $1\frac{1}{4}$ inches.

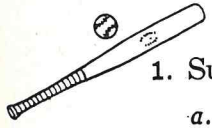
3. Use these two methods to find how much $3\frac{3}{4}$ inches less $2\frac{1}{2}$ inches is.

4. Subtract $1\frac{1}{2}$ from $2\frac{3}{4}$. Show with a ruler that your subtraction is correct.

5. Use lines and a ruler to find the answers to these examples. Check by subtraction.

a. $3\frac{3}{4}$ in. $-2\frac{1}{2}$ in. $=$ *b.* $4\frac{7}{8}$ in. $-\frac{1}{2}$ in. $=$ *c.* $3\frac{1}{2}$ in. $-1\frac{3}{8}$ in. $=$

d. $2\frac{1}{2}$ in. $-1\frac{1}{4}$ in. $=$ *e.* $\frac{3}{4}$ in. $-\frac{1}{8}$ in. $=$ *f.* $4\frac{3}{4}$ in. $-2\frac{5}{8}$ in. $=$



LET'S PRACTICE

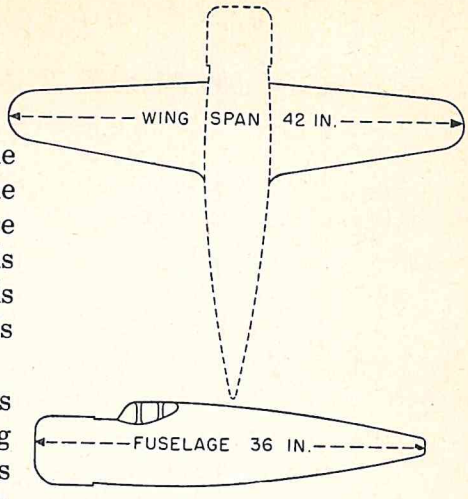
1. Supply the missing numerators:

a. $1\frac{1}{4} = \frac{\quad}{4}$ *b.* $3\frac{1}{4} = 2\frac{\quad}{4}$ *c.* $6\frac{3}{8} = 5\frac{\quad}{8}$ *d.* $9 = 8\frac{\quad}{3}$

Watch the signs:

	a	*b*	*c*	*d*	*e*	*f*
2.	$4\frac{1}{2}$ $+7\frac{1}{2}$	13 $-8\frac{1}{2}$	$5\frac{1}{2}$ $+3\frac{1}{6}$	$9\frac{7}{8}$ $+\frac{1}{2}$	$3\frac{1}{2}$ $-1\frac{1}{4}$	$\frac{1}{4}$ $+\frac{1}{6}$
3.	$2\frac{1}{2}$ $+3\frac{2}{3}$	$6\frac{1}{4}$ $+4\frac{1}{8}$	$7\frac{1}{2}$ $+6\frac{7}{10}$	$9\frac{1}{4}$ $-7\frac{3}{4}$	$8\frac{3}{4}$ $+5\frac{7}{8}$	$\frac{1}{2}$ $-\frac{1}{4}$
4.	$6\frac{1}{3}$ $-4\frac{2}{3}$	$6\frac{7}{8}$ $-5\frac{1}{2}$	$9\frac{1}{4}$ $+7\frac{3}{4}$	$1\frac{1}{3}$ $-\frac{2}{3}$	$4\frac{4}{5}$ $+2\frac{1}{2}$	$4\frac{2}{3}$ $-1\frac{2}{3}$
5.	$6\frac{5}{8}$ $+7\frac{3}{4}$	$9\frac{1}{4}$ $+8\frac{1}{5}$	$7\frac{3}{8}$ $-2\frac{5}{8}$	$8\frac{1}{2}$ $+7\frac{3}{4}$	$4\frac{5}{6}$ $-2\frac{2}{3}$	$7\frac{2}{3}$ $+6\frac{3}{4}$

A MODEL AIRPLANE



1. The diagram tells some facts about the model airplane David is making. The distance from wing tip to wing tip is called the **wing span.** What is the wing span of David"s model?

The body of an airplane is called the **fuselage.** How long is the fuselage of David's model? The airplane of which David is making a model is 20 times as large as the model. How long is the fuselage of the real airplane? What is its wing span?

2. The fuselage of the model weighs $4\frac{1}{4}$ ounces. The wings weigh $1\frac{3}{8}$ ounces. Find the weight of the model.

3. How much less than a pound does the model weigh?

4. How much more than a yard is the wing span of the model? Express the amount as a fraction of a yard.

5. The first time the boys flew the plane they made 75 turns of the winder. Now they make 600 turns. How many times as many turns as they made the first time do they make now?

6. The longest time their model airplane has stayed in the air is $54\frac{1}{2}$ minutes. How much less than an hour is this?

7. The boys estimate that the highest it has flown above the ground is about 250 feet. Express this distance as yards.

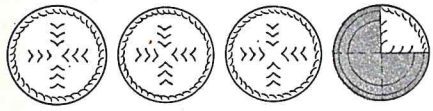
8. One day the model plane flew a distance of 2.640 yards in 6 minutes. What fraction of a mile did it fly in a minute?

*9. How large are airplanes today? How far can they fly? How fast do they fly? What are "gliders"?

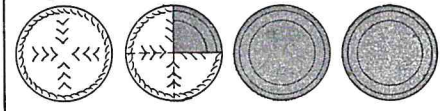
SUBTRACTING MIXED NUMBERS HAVING UNLIKE FRACTIONS

1. There were $3\frac{1}{4}$ pies on a shelf. For dinner $1\frac{1}{2}$ pies were eaten. How many pies were left?

The Pies on the Shelf



After $1\frac{1}{2}$ Pies Were Eaten



THINK: $3\frac{1}{4} - 1\frac{1}{2} = ?$

$$\begin{array}{rrr} 3\frac{1}{4} & = 3\frac{1}{4} & = 2\frac{5}{4} \\ -1\frac{1}{2} & = 1\frac{2}{4} & = 1\frac{2}{4} \\ & & 1\frac{3}{4} \end{array}$$

First change $1\frac{1}{2}$ to $1\frac{2}{4}$. Why?
How do we change $3\frac{1}{4}$ to $2\frac{5}{4}$?
How do we get the $1\frac{3}{4}$?

2. Study these examples. Then copy, and work them with your book closed.

$$\begin{array}{rrr} 48\frac{1}{2} & = 48\frac{2}{4} & = 47\frac{6}{4} \\ -43\frac{3}{4} & = 43\frac{3}{4} & = 43\frac{3}{4} \\ & & 4\frac{3}{4} \end{array}$$

b. $\begin{array}{rrr} 4\frac{1}{3} & = 4\frac{2}{6} & = 3\frac{8}{6} \\ -\frac{5}{6} & = \frac{5}{6} & = \frac{5}{6} \\ & & 3\frac{3}{6} = 3\frac{1}{2} \end{array}$

3. Find the missing numbers:

a. $4\frac{1}{2} = 4\frac{\quad}{4} = 3\frac{\quad}{4}$ *b.* $6\frac{1}{3} = 6\frac{\quad}{6} = 5\frac{\quad}{6}$ *c.* $7\frac{1}{4} = 7\frac{\quad}{8} = 6\frac{\quad}{8}$

d. $5\frac{3}{4} = 5\frac{\quad}{8} = 4\frac{\quad}{8}$ *e.* $3\frac{5}{6} = 3\frac{\quad}{12} = 2\frac{\quad}{12}$ *f.* $4\frac{2}{3} = 4\frac{\quad}{6} = 3\frac{\quad}{6}$

Subtract:

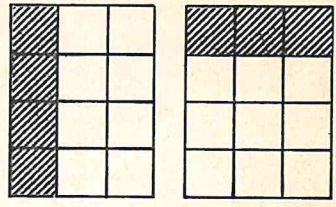
	a	*b*	*c*	*d*	*e*	*f*
4.	$14\frac{1}{4}$ $5\frac{1}{2}$	$13\frac{3}{8}$ $7\frac{1}{2}$	$16\frac{1}{2}$ $8\frac{7}{8}$	$13\frac{1}{8}$ $9\frac{1}{2}$	$15\frac{5}{8}$ $8\frac{3}{4}$	$18\frac{1}{2}$ $9\frac{3}{4}$
5.	$15\frac{1}{6}$ $9\frac{1}{2}$	$16\frac{1}{10}$ $7\frac{1}{5}$	$14\frac{1}{2}$ $6\frac{3}{4}$	$17\frac{1}{6}$ $8\frac{1}{3}$	$14\frac{1}{8}$ $8\frac{1}{4}$	$15\frac{1}{4}$ $6\frac{3}{8}$
6.	$13\frac{1}{3}$ $8\frac{5}{6}$	$17\frac{1}{2}$ $9\frac{5}{8}$	$14\frac{1}{4}$ $9\frac{1}{2}$	$15\frac{3}{4}$ $7\frac{7}{8}$	$16\frac{1}{2}$ $9\frac{5}{6}$	$14\frac{1}{8}$ $7\frac{3}{4}$

SUBTRACTING UNLIKE FRACTIONS

1. Which is larger, $\frac{1}{3}$ of a square or $\frac{1}{4}$ of a square?

a. Show that $\frac{1}{3}$ of Box A is shaded. Show that $\frac{1}{4}$ of Box B is shaded.

b. To find how much more of Box A is shaded than of Box B, divide both boxes into twelfths.



Box A Box B

The picture shows that $\frac{1}{3} - \frac{1}{4} = \frac{4}{12} - \frac{3}{12} = \frac{1}{12}$.

We work the example, $\frac{1}{3} - \frac{1}{4}$, like this:

$\frac{1}{3} = \frac{4}{12}$
$-\frac{1}{4} = \frac{3}{12}$
$\frac{1}{12}$

Can we use either 3 or 4 as the denominator?
How do we find the denominator 12?
How do we change $\frac{1}{3}$ to $\frac{4}{12}$? $\frac{1}{4}$ to $\frac{3}{12}$?
$\frac{1}{12}$ more of Box A is shaded than of Box B.

To find the common denominator for fractions of this kind we multiply the two denominators.

2. Study the examples below. Then copy the examples without the work and find the answers.

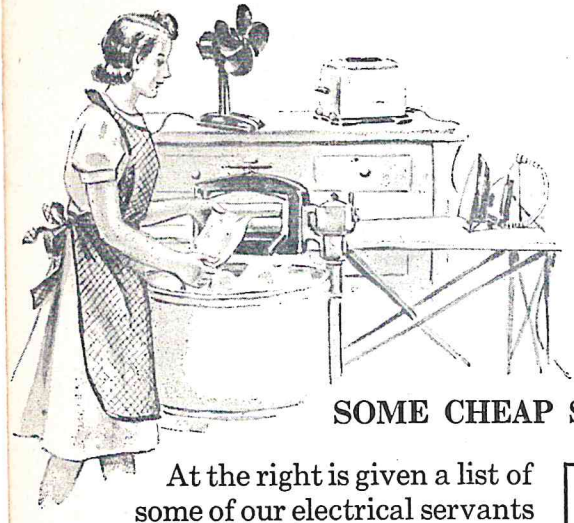
a. $\frac{3}{4} = \frac{9}{12}$
$-\frac{2}{3} = \frac{8}{12}$
$\frac{1}{12}$

b. $\frac{5}{6} = \frac{10}{12}$
$-\frac{1}{4} = \frac{3}{12}$
$\frac{7}{12}$

c. $\frac{4}{5} = \frac{8}{10}$
$-\frac{1}{2} = \frac{5}{10}$
$\frac{3}{10}$

Tell what denominator to use in subtracting the numbers in each example, then subtract:

	a	*b*	*c*	*d*	*e*	*f*
3.	$\frac{2}{3}$ $\frac{1}{2}$	$\frac{2}{3}$ $\frac{1}{4}$	$\frac{1}{2}$ $\frac{1}{5}$	$\frac{3}{4}$ $\frac{1}{3}$	$\frac{4}{5}$ $\frac{3}{4}$	$\frac{7}{8}$ $\frac{2}{3}$
4.	$\frac{1}{4}$ $\frac{1}{6}$	$\frac{1}{6}$ $\frac{1}{8}$	$\frac{7}{8}$ $\frac{5}{6}$	$\frac{3}{4}$ $\frac{1}{10}$	$\frac{3}{4}$ $\frac{1}{6}$	$\frac{5}{6}$ $\frac{3}{4}$
5.	$\frac{3}{8}$ $\frac{1}{6}$	$\frac{2}{5}$ $\frac{1}{4}$	$\frac{5}{6}$ $\frac{1}{4}$	$\frac{5}{6}$ $\frac{3}{8}$	$\frac{3}{4}$ $\frac{2}{5}$	$\frac{5}{6}$ $\frac{2}{3}$



SOME CHEAP SERVANTS

At the right is given a list of some of our electrical servants and the cost in a certain western city of using each of them for one hour. Use addition or subtraction to find the answers to the problems below.

Cost of Using Electricity for 1 Hour	
Flatiron	$3\frac{3}{4}¢$
Vacuum Cleaner	$2\frac{1}{4}¢$
Washing Machine	$2\frac{1}{2}¢$
Toaster	$3\frac{1}{4}¢$
Fan	$\frac{1}{2}¢$
Sewing Machine	$\frac{3}{10}¢$
50-Watt Bulb	$\frac{1}{4}¢$

1. How much does it cost to use a flatiron for 3 hours?

2. How much more does it cost to use a flatiron for an hour than it does to use a vacuum cleaner?

3. How much less does it cost to use a washing machine for an hour than it does to use a toaster?

4. How much does it cost to use an electric fan for 5 hours?

5. Alice left a 50-watt bulb burning one morning in her bedroom. If it was using electricity for 4 hours, how much did the electricity Alice wasted cost?

6. If a dressmaker uses a sewing machine for 4 hours, how much does the electricity for it cost?

*7. What is a kilowatt? What are the rates for electricity where you live?

SUBTRACTING DIFFICULT MIXED NUMBERS

1. John has $3\frac{3}{4}$ bars of candy. Ann has $1\frac{1}{3}$ bars. How much more candy has John than Ann?

THINK: $3\frac{3}{4} - 1\frac{1}{3} = ?$

$$\begin{array}{r} 3\frac{3}{4} = 3\frac{9}{12} \\ -1\frac{1}{3} = 1\frac{4}{12} \\ \hline 2\frac{5}{12} \end{array}$$

We work the example, $3\frac{3}{4} - 1\frac{1}{3}$, like this: First change **both** fractions to twelfths. Why? Then subtract. John has $2\frac{5}{12}$ bars more than Ann.

2. Study the work below carefully. Then copy the examples, and work them with your book closed.

a. $\begin{array}{r} 4\frac{3}{4} = 4\frac{15}{20} \\ -\frac{1}{5} = \frac{4}{20} \\ \hline 4\frac{11}{20} \end{array}$ *b.* $\begin{array}{r} 4\frac{5}{6} = 4\frac{10}{12} \\ -2\frac{3}{4} = 2\frac{9}{12} \\ \hline 2\frac{1}{12} \end{array}$ *c.* $\begin{array}{r} 6\frac{5}{8} = 6\frac{15}{24} \\ -1\frac{1}{6} = 1\frac{4}{24} \\ \hline 5\frac{11}{24} \end{array}$

Find the missing terms:

	a	*b*	*c*	*d*	*e*
3.	$2\frac{1}{2} = 2\frac{\quad}{6}$	$2\frac{4}{5} = 2\frac{\quad}{10}$	$4\frac{1}{2} = 4\frac{\quad}{6}$	$5\frac{2}{5} = 5\frac{\quad}{20}$	$6\frac{1}{8} = 6\frac{\quad}{24}$
4.	$3\frac{1}{3} = 3\frac{\quad}{6}$	$1\frac{1}{2} = 1\frac{\quad}{10}$	$7\frac{1}{4} = 7\frac{\quad}{12}$	$7\frac{2}{3} = 7\frac{\quad}{12}$	$7\frac{5}{6} = 7\frac{\quad}{24}$

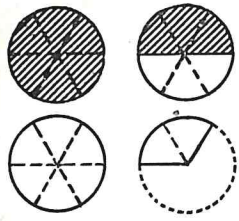
First tell what denominator to use. Then subtract:

	a	*b*	*c*	*d*	*e*	*f*
5.	$12\frac{3}{4}$ $4\frac{1}{3}$	$12\frac{1}{3}$ $8\frac{1}{4}$	$11\frac{1}{3}$ $2\frac{1}{8}$	$11\frac{2}{3}$ $7\frac{1}{4}$	$12\frac{1}{2}$ $9\frac{1}{3}$	$13\frac{3}{4}$ $4\frac{2}{5}$
6.	$11\frac{5}{6}$ $4\frac{3}{4}$	$10\frac{1}{4}$ $4\frac{1}{5}$	$12\frac{1}{2}$ $5\frac{2}{5}$	$13\frac{2}{3}$ $5\frac{5}{8}$	$11\frac{3}{4}$ $5\frac{2}{3}$	$12\frac{5}{6}$ $3\frac{3}{8}$

MIXED PRACTICE WITH FRACTIONS

	a	*b*	*c*	*d*	*e*	*f*
1.	$4\frac{2}{3}$ $+3\frac{5}{6}$	9 $-2\frac{1}{4}$	$11\frac{1}{2}$ $-3\frac{1}{4}$	$6\frac{1}{4}$ $+7\frac{1}{3}$	$9\frac{5}{8}$ $-6\frac{7}{8}$	$7\frac{1}{4}$ $+\frac{5}{8}$
2.	$8\frac{1}{4}$ $-6\frac{1}{2}$	$6\frac{3}{4}$ $-\frac{1}{5}$	$\frac{3}{4}$ $+4\frac{5}{6}$	$7\frac{1}{3}$ $-6\frac{5}{6}$	$9\frac{3}{4}$ $-5\frac{1}{6}$	$8\frac{5}{6}$ $+3\frac{7}{8}$

A STEP IN SUBTRACTING MIXED NUMBERS



$$3\tfrac{1}{3} = 3\tfrac{2}{6} = 2\tfrac{8}{6}$$
$$-1\tfrac{1}{2} = 1\tfrac{3}{6} = 1\tfrac{3}{6}$$
$$1\tfrac{5}{6}$$

1. The circles show $3\frac{1}{3} - 1\frac{1}{2}$ How many circles are not shaded? This shows that $3\frac{1}{3} - 1\frac{1}{2} = 1\frac{5}{6}$.

We work the example, $3\frac{1}{3} - 1\frac{1}{2}$, as shown at the left:

Why must we change both fractions to sixths?

Why must we then change $3\frac{2}{6}$ to $2\frac{8}{6}$? How do we get the $1\frac{5}{6}$?

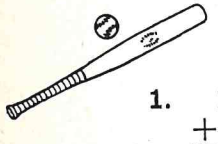
2. Study the examples below, then copy the examples without the work and find the answers.

a. $8\frac{1}{3} = 8\frac{4}{12} = 7\frac{16}{12}$
$-\frac{3}{4} = \frac{9}{12} = \frac{9}{12}$
$7\frac{7}{12}$

b. $9\frac{1}{4} = 9\frac{3}{12} = 8\frac{15}{12}$
$-\frac{5}{6} = \frac{10}{12} = \frac{10}{12}$
$8\frac{5}{12}$

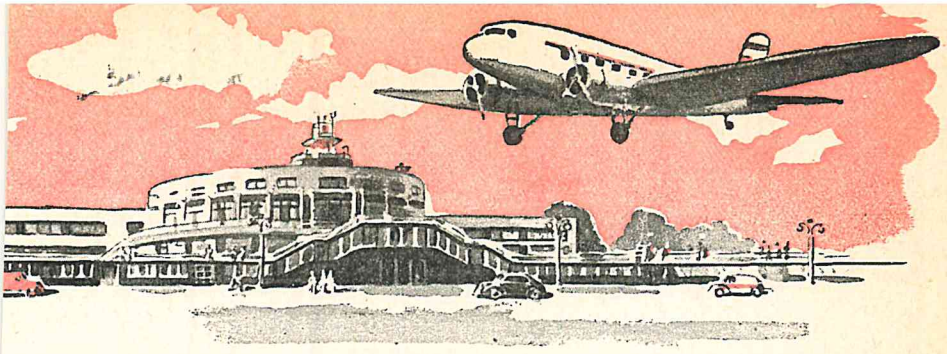
Tell what denominator to use in each example below, then subtract:

	a	*b*	*c*	*d*	*e*	*f*
3.	$8\frac{1}{2}$ $2\frac{2}{3}$	$9\frac{2}{3}$ $4\frac{3}{4}$	$7\frac{1}{2}$ $4\frac{2}{5}$	$8\frac{1}{4}$ $3\frac{1}{3}$	$9\frac{3}{4}$ $8\frac{7}{8}$	$12\frac{2}{5}$ $6\frac{3}{4}$
4.	$7\frac{1}{6}$ $3\frac{3}{4}$	$9\frac{1}{4}$ $2\frac{1}{2}$	$14\frac{1}{4}$ $7\frac{2}{5}$	$16\frac{1}{4}$ $9\frac{5}{6}$	$5\frac{5}{6}$ $\frac{7}{8}$	$18\frac{1}{8}$ $9\frac{1}{6}$
5.	$16\frac{1}{8}$ $8\frac{7}{8}$	$7\frac{1}{2}$ $4\frac{1}{2}$	$6\frac{3}{4}$ $1\frac{7}{8}$	$12\frac{1}{2}$ $9\frac{2}{3}$	$9\frac{5}{6}$ $4\frac{3}{4}$	$8\frac{1}{6}$ $\frac{3}{8}$



LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	27.8 +19.5	$5\frac{1}{4}$ $+6\frac{1}{2}$	\$7.68 ×98	$9\frac{1}{3}$ $-7\frac{1}{2}$	87.4 −25.3
2.	987 ×706	$69\overline{)6003}$	$6\frac{3}{4}$ $+7\frac{3}{4}$	8 $-2\frac{1}{4}$	$24\overline{)9744}$



LET'S GO BY AIRPLANE

Many people travel by airplane rather than by train because the time required by airplane is so much less.

Here are some airplane schedules to New York City from several parts of the country for a recent year:

Cleveland	$2\frac{1}{3}$ hr.	Omaha	7 hr.
Chicago	$3\frac{5}{6}$ hr.	Salt Lake City	$12\frac{1}{2}$ hr.
Minneapolis	$7\frac{1}{3}$ hr.	San Francisco	$19\frac{1}{3}$ hr.

1. How much longer does it take a plane to go from Chicago to New York than from Cleveland to New York?

2. The fastest train from Chicago to New York makes the distance in 17 hours. How much less time does it take an airplane?

3. The trip from Minneapolis to New York is by way of Chicago. How much more time does the trip from Minneapolis to New York take than the trip from Chicago to New York?

4. How much less than a day does it take to fly from San Francisco to New York?

5. The trip from San Francisco is by way of Omaha, Salt Lake City, and Chicago. How long does the trip take from San Francisco to Salt Lake City? from Salt Lake City to Chicago?

*6. What is meant by airplane "sleeper service"?

THINGS TO REMEMBER IN SUBTRACTING FRACTIONS

1. Before unlike fractions can be subtracted, they must be changed to the same denominator.

2. Be sure to express all answers in simplest form.

3. To subtract $2\frac{1}{2}$ from 5, how must the form of 5 be changed?

4. What are the steps in subtracting $3\frac{1}{4}$ from $5\frac{1}{8}$? Be sure to change $5\frac{1}{8}$ to $4\frac{9}{8}$. Be sure to change the 5 to 4.

5. Remember that $\frac{1}{8} - \frac{1}{8}$ equals 0. In subtracting $2\frac{1}{8}$ from $3\frac{1}{8}$, the answer is 1. So do not write the 0.

6. How can you use addition to check the answer to an example in subtraction of fractions?

7. Be sure to go over all of your work to find any errors due to carelessness or inaccurate work.

PRACTICE IN SUBTRACTING FRACTIONS

The examples below are the most difficult ones found in a test given to a large number of sixth-grade boys and girls. How many of them can you work correctly? If you can work all of them correctly the first time, you know how to subtract fractions very well.

Subtract:

	a	*b*	*c*	*d*	*e*	*f*
1.	$2\frac{1}{6}$ $\frac{2}{3}$	$3\frac{1}{4}$ $2\frac{5}{8}$	$4\frac{2}{3}$ $\frac{2}{3}$	$4\frac{1}{8}$ $1\frac{7}{8}$	$3\frac{1}{6}$ $1\frac{2}{3}$	$9\frac{3}{5}$ $8\frac{4}{5}$
2.	3 $2\frac{5}{12}$	$2\frac{1}{2}$ $2\frac{1}{2}$	$1\frac{1}{8}$ $\frac{5}{8}$	$1\frac{1}{2}$ $\frac{5}{6}$	$1\frac{1}{3}$ $\frac{1}{2}$	$6\frac{1}{4}$ $5\frac{2}{3}$
3.	$3\frac{3}{4}$ $1\frac{1}{6}$	$7\frac{2}{3}$ $5\frac{1}{2}$	$6\frac{3}{5}$ $5\frac{3}{4}$	$9\frac{1}{2}$ $6\frac{3}{4}$	$8\frac{7}{10}$ $5\frac{4}{5}$	$5\frac{5}{6}$ $3\frac{7}{8}$

What errors did you make on these sets of examples?

FINDING REASONS FOR ERRORS IN SUBTRACTING FRACTIONS

The examples below contain the kinds of errors that we know are made most frequently by boys and girls in subtracting fractions. Study each example carefully and be ready to tell what the error is and to show the correct work.

1. $\begin{array}{r} \frac{7}{8} \\ -\frac{1}{8} \\ \hline \frac{8}{8} \end{array} = 1$

2. $\begin{array}{r} 9\frac{3}{4} \\ -2\frac{1}{4} \\ \hline 6\frac{2}{4} \end{array} = \frac{1}{2}$

3. $4\frac{2}{3} = 4\frac{3}{6}$
$\frac{5}{6} = \frac{5}{6}$
$4\frac{2}{6} = 4\frac{1}{3}$

4. $\begin{array}{r} 6\frac{3}{4} \\ -2\frac{1}{4} \\ \hline 4\frac{2}{4} \end{array}$

5. $\begin{array}{r} 5\frac{1}{2} \\ -\frac{1}{2} \\ \hline 50 \end{array}$

6. $4\frac{2}{3} = 3\frac{5}{3}$
$-\frac{2}{3} = \frac{2}{3}$
$3\frac{3}{3}$

7. $\begin{array}{r} 8\frac{1}{4} \\ -\frac{1}{4} \\ \hline 8\frac{0}{4} \end{array}$

8. $\begin{array}{r} 9 \\ -2\frac{1}{10} \\ \hline 7\frac{1}{10} \end{array}$

9. $4\frac{1}{8} = 4\frac{1}{8} = 3\frac{1}{8}$
$\frac{3}{4} = \frac{6}{8} = \frac{6}{8}$
$3\frac{5}{8}$

Make a list of the kinds of errors there are in these examples. Do you ever make such errors yourself?

PRACTICE IN FINDING ERRORS

Examine your paper after you have worked the examples below to find the reasons for any errors you may make. Try not to repeat the errors.

	a	*b*	*c*	*d*	*e*	*f*
1.	$\begin{array}{r} 8\frac{1}{4} \\ 4\frac{3}{4} \\ \hline \end{array}$	$\begin{array}{r} 15\frac{7}{8} \\ 2\frac{1}{4} \\ \hline \end{array}$	$\begin{array}{r} 9\frac{7}{8} \\ 4\frac{1}{8} \\ \hline \end{array}$	$\begin{array}{r} 7 \\ 3\frac{3}{4} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{7}{10} \\ 2\frac{2}{5} \\ \hline \end{array}$	$\begin{array}{r} 6\frac{1}{4} \\ \frac{1}{4} \\ \hline \end{array}$
2.	$\begin{array}{r} 6\frac{3}{8} \\ \frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 8\frac{1}{2} \\ 7\frac{5}{6} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{3}{10} \\ 3\frac{3}{5} \\ \hline \end{array}$	$\begin{array}{r} 9\frac{1}{3} \\ \frac{5}{6} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{1}{2} \\ 6\frac{3}{4} \\ \hline \end{array}$	$\begin{array}{r} 6\frac{1}{6} \\ \frac{2}{3} \\ \hline \end{array}$
3.	$\begin{array}{r} 5\frac{3}{4} \\ \frac{5}{6} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{1}{2} \\ 4\frac{2}{3} \\ \hline \end{array}$	$\begin{array}{r} 6\frac{2}{5} \\ \frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 7\frac{5}{6} \\ \frac{7}{8} \\ \hline \end{array}$	$\begin{array}{r} 8\frac{1}{4} \\ 3\frac{2}{5} \\ \hline \end{array}$	$\begin{array}{r} 9\frac{2}{3} \\ 8\frac{3}{4} \\ \hline \end{array}$

Did you make any errors in working these examples? What were they?

MAGIC SQUARES

These are magic squares. The sums in each row and column should be the same. See if they are.

1.

2	$\frac{1}{4}$	$1\frac{1}{2}$
$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{3}{4}$
1	$2\frac{1}{4}$	$\frac{1}{2}$

2.

2	$\frac{5}{6}$	$1\frac{2}{3}$
$1\frac{1}{6}$	$1\frac{1}{2}$	$1\frac{5}{6}$
$1\frac{1}{3}$	$2\frac{1}{6}$	1

3.

2	$\frac{1}{4}$	$\frac{3}{8}$	$1\frac{5}{8}$
$\frac{5}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$	1
$1\frac{1}{8}$	$\frac{7}{8}$	$\frac{3}{4}$	$1\frac{1}{2}$
$\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{7}{8}$	$\frac{1}{8}$

Find the missing numbers in these squares:

4.

$5\frac{1}{4}$	$1\frac{3}{4}$	2	$4\frac{1}{2}$
$2\frac{1}{2}$	?	$3\frac{3}{4}$	$3\frac{1}{4}$
$3\frac{1}{2}$	3	$2\frac{3}{4}$	?
$2\frac{1}{4}$	$4\frac{3}{4}$	?	$1\frac{1}{2}$

5.

$2\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{2}$	?
$\frac{5}{6}$	$1\frac{5}{6}$	?	$1\frac{1}{3}$
$1\frac{1}{2}$	$1\frac{1}{6}$	1	2
?	$2\frac{1}{3}$	?	$\frac{1}{6}$

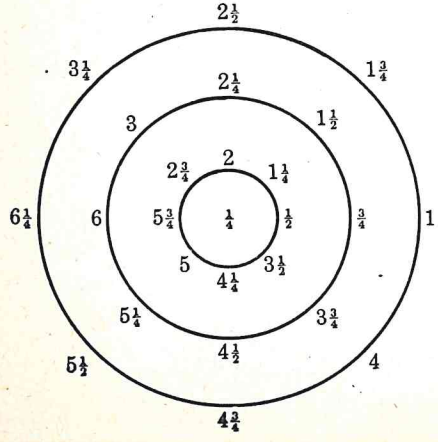
6.

$1\frac{7}{10}$	$2\frac{2}{5}$	?	$\frac{4}{5}$	$1\frac{1}{2}$
?	$\frac{1}{2}$	$\frac{7}{10}$	?	$1\frac{3}{5}$
$\frac{2}{5}$	$\frac{3}{5}$	$1\frac{3}{10}$	2	?
1	$1\frac{1}{5}$	?	$2\frac{1}{10}$	$\frac{3}{10}$
$1\frac{1}{10}$	$1\frac{4}{5}$	?	$\frac{1}{5}$	$\frac{9}{10}$

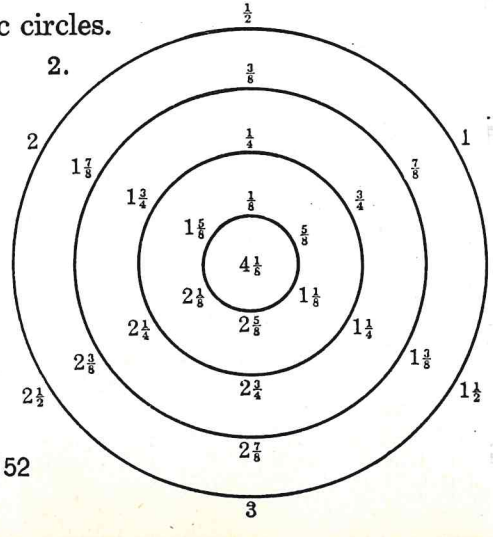
MAGIC CIRCLES

Show that these are magic circles.

1.



2.



DIAGNOSTIC TEST IN SUBTRACTING UNLIKE FRACTIONS

Work the examples in this test carefully. If you work only one or two examples in a row incorrectly, correct your work at once. If you work more than two examples in a row incorrectly, it will pay you to study again the work on the page in heavy type at the right of the row.

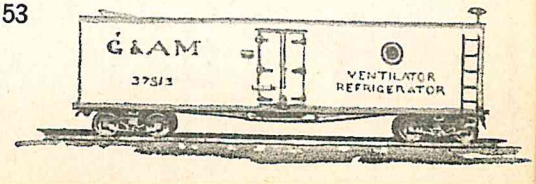
	a	*b*	*c*	*d*	*e*	*f*	
1.	$\frac{1}{2}$ $\frac{1}{4}$	$\frac{3}{4}$ $\frac{1}{2}$	$\frac{7}{8}$ $\frac{1}{4}$	$\frac{1}{2}$ $\frac{1}{6}$	$\frac{2}{3}$ $\frac{1}{6}$	$\frac{1}{2}$ $\frac{3}{10}$	(139)
2.	$4\frac{3}{8}$ $2\frac{1}{4}$	$5\frac{1}{4}$ $2\frac{1}{8}$	$6\frac{1}{2}$ $4\frac{1}{4}$	$3\frac{1}{2}$ $\frac{1}{6}$	$4\frac{5}{6}$ $2\frac{1}{3}$	$7\frac{1}{2}$ $4\frac{1}{10}$	(140)
3.	$6\frac{1}{2}$ $2\frac{2}{4}$	$7\frac{1}{4}$ $\frac{1}{2}$	$6\frac{1}{8}$ $5\frac{1}{4}$	$8\frac{1}{6}$ $\frac{1}{2}$	$7\frac{2}{3}$ $4\frac{5}{6}$	$9\frac{1}{6}$ $\frac{1}{3}$	(144)
4.	$\frac{1}{3}$ $\frac{1}{4}$	$\frac{1}{4}$ $\frac{1}{5}$	$\frac{2}{3}$ $\frac{1}{4}$	$\frac{1}{4}$ $\frac{1}{6}$	$\frac{5}{6}$ $\frac{3}{8}$	$\frac{7}{8}$ $\frac{1}{6}$	(145)
5.	$2\frac{3}{4}$ $1\frac{1}{3}$	$8\frac{2}{5}$ $3\frac{1}{4}$	$7\frac{3}{4}$ $2\frac{1}{6}$	$9\frac{1}{3}$ $6\frac{3}{4}$	$8\frac{1}{2}$ $7\frac{3}{5}$	$9\frac{3}{4}$ $7\frac{4}{5}$	(147)

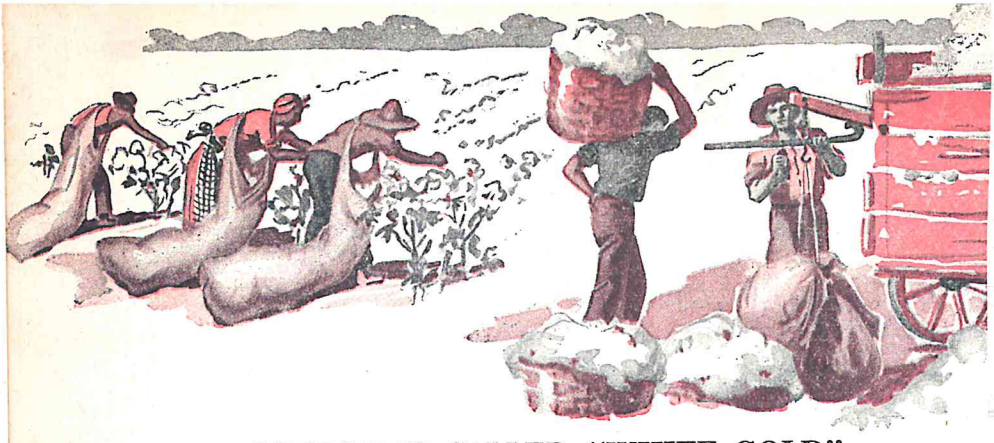
Checking Up

1. Repeat the diagnostic test on subtracting like fractions on page 22.
2. Check up on addition of fractions by repeating the tests on pages 22 and 130.

*INTERESTING FACTS TO FIND OUT

1. The cost of airplane travel.
2. How much gasoline an airplane uses.
3. The uses of electricity in our homes.
4. Why we need refrigerator cars.





COTTON IS CALLED "WHITE GOLD"

1. About March 1, cotton seeds are planted in rows in the fields of the south. By the middle of September the cotton is ready for picking. About how many months does it take before cotton is ready for picking?

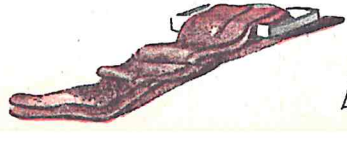
2. Good sea-island cotton, the most expensive and the strongest of the cotton fibers, is about $1\frac{3}{4}$ inches long. Ordinary American cotton has fibers about $\frac{3}{4}$ of an inch long. Find the difference in the length of the fibers of these two kinds of cotton.

3. About 900 pounds of seed cotton are raised on an acre when the crop is good. How many pounds would be raised on a 50-acre farm?

4. A good cotton picker can pick about 100 pounds of sea island cotton a day. How many pounds can he pick in 15 days?

5. One year cotton pickers were paid 50 cents for picking 100 pounds of seed cotton. Mose picked 900 pounds of cotton. How much did he earn?

6. Every 1500 pounds of sea island cotton is separated by the cotton gin into 500 pounds of lint, used for cloth, and 1000 pounds of cottonseed. What part of the total weight of the cotton is the lint? the cottonseed?



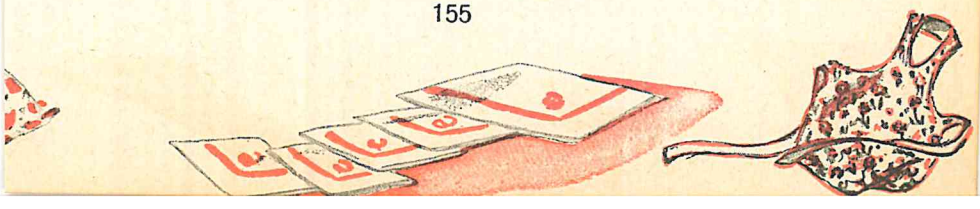
7. A cotton gin with a single roller can clean about 3000 pounds of seed cotton a day. How many pounds of lint would this make, counting $\frac{1}{3}$ of the total weight as lint?

*8. From a crop of 23,000 pounds of seed cotton, a farmer got 8000 pounds of lint and 15,000 pounds of cottonseed. He sold the lint for 9 cents a pound and the cottonseed for 2 cents a pound. How much money did the farmer receive?

*9. Cotton is sold in bales weighing about 500 pounds each. In a recent year we produced 18,248,951 bales of cotton. Write this number in words. A bale is about 54 inches high, 27 inches thick, and 45 inches long. Try to show by a box, or in some other way, how large a bale is.

*10. Cotton seeds are used to make cottonseed oil. A ton of cottonseed will yield about 300 pounds of oil. What part of the weight of the cottonseed is the weight of the oil? What is cottonseed oil used for?

*11. In 1921 the price of cotton (excluding linters) was 21 cents a pound and in 1932 the price was 6 cents a pound. How many times as much was cotton worth in 1921 as it was in 1932? In the same period, cottonseed went from $54 a ton in 1920 to $12 a ton in 1933. Cottonseed was worth how many times as much a ton in 1920 as it was in 1933? Can you think of reasons for the differences in the amounts the farmer was paid in these two years?



WORKING WITH MEASURES

1. A dressmaker had two pieces of cloth, one piece 4 yards 2 feet long, the other piece 2 yards 2 feet long. How long were the two pieces of cloth?

4 yd. 2 ft.	Add the feet, then the yards.
+2 yd. 2 ft.	Change 4 ft. to 1 yd. 1 ft.
6 yd. 4 ft. = 7 yd. 1 ft.	6 yd. 4 ft. = 7 yd. 1 ft.

2. Show that the following are correct:

a. 7 ft. 14 in. = 8 ft. 2 in.

b. 4 hr. 75 min. = 5 hr. 15 min.

c. 3 gal. 6 qt. = 4 gal. 2 qt.

d. 6 lb. 28 oz. = 7 lb. 12 oz.

e. Why do we not change an answer like 2 feet 4 inches?

Find the sums:

3. 5 ft. $8\frac{1}{2}$ in.
   6 ft. 3 in.

5. 9 hr. 20 min.
   6 hr. 35 min.

7. 4 min. 8 sec.
   9 min. 55 sec.

4. 3 lb. 10 oz.
   5 lb. 12 oz.

6. 3 gal. $2\frac{1}{2}$ qt.
   4 gal. 3 qt.

8. 8 ft. $4\frac{1}{2}$ in.
   4 ft. $3\frac{3}{4}$ in.

9. A dressmaker cut 1 yard $2\frac{1}{2}$ feet from a piece of cloth 4 yards 2 feet long. How long was the piece that was left?

10. Show that the following are correct:

a. 5 ft. 4 in. = 4 ft. 16 in.

b. 6 lb. 3 oz. = 5 lb. 19 oz.

c. 3 min. 15 sec. = 2 min. 75 sec.

d. 3 gal. 1 qt. = 2 gal. 5 qt.

Subtract:

11. 5 ft. 8 in.
    2 ft. $6\frac{1}{2}$ in.

13. 9 hr. 25 min.
    3 hr. 40 min.

15. 9 min. $10\frac{1}{5}$ sec.
    3 min. 45 sec.

12. 4 lb. 3 oz.
    2 lb. 8 oz.

14. 6 gal. $1\frac{1}{2}$ qt.
    2 gal. 3 qt.

16. 7 ft. 6 in.
    4 ft. $9\frac{1}{2}$ in.

LET'S PRACTICE

Practice one set of these examples a day. If you need more practice, work the same set of examples on several days. Keep a record of your scores on each trial to see how your work improves.

Set I

1. $968.5 + 97.5 + 3125.8 + 7.6 + 285.9 + 47.9$

2. $97.843 - 2.953$

3. $9\frac{1}{2} + 7\frac{3}{4}$

4. $86\overline{)3612}$

5. 640×800

6. $64\overline{)30080}$

7. $6\frac{1}{4} - 4\frac{1}{2}$

8. $8\frac{3}{4} + 5\frac{5}{6}$

9. $\$9.58 \times 64$

10. $47\overline{)2868}$

Set II

1. $3.764 + 89.592 + .484 + 1.897 + .004 + 68.957$

2. $84.51 - 75.49$

3. $8\frac{7}{8} + 6\frac{1}{2}$

4. $98\overline{)23030}$

5. 509×708

6. $78\overline{)6552}$

7. $14\frac{2}{3} - 8\frac{1}{6}$

8. $27\frac{5}{6} + 16\frac{7}{8}$

9. $\$37.65 \times 90$

10. $56\overline{)5040}$

Set III

1. $\$34.58 + .78 + 7.73 + 783.49 + 26.65 + 664.96$

2. $896.4 - 746.4$

3. $9\frac{3}{4} + 4\frac{1}{8}$

4. $28\overline{)14196}$

5. $9 - 8\frac{3}{5}$

6. 649×590

7. $16\frac{1}{3} - 5\frac{1}{2}$

8. $17\overline{)1258}$

9. 738×837

10. $38\overline{)3002}$

HOW WELL DO YOU REMEMBER?

1. Explain each step in working the example below:

$$\begin{array}{rcrcr} 13\frac{3}{4} & = & 13\frac{9}{12} & = & 12\frac{21}{12} \\ 5\frac{5}{6} & = & 5\frac{10}{12} & = & 5\frac{10}{12} \\ & & & & \overline{7\frac{11}{12}} \end{array}$$

2. What are some of the kinds of errors boys and girls make in subtracting fractions?
3. Give the value of each figure in the number 25.684.
4. Show that 250,000 is $\frac{1}{4}$ million.
5. Write with figures $2\frac{1}{2}$ million.
6. Express to the nearest inch: $6\frac{3}{4}$ in., $7\frac{3}{8}$ in., $9\frac{1}{2}$ in.
7. How do you find the area of a sheet of paper?
8. Which is more, $\frac{3}{4}$ or $\frac{5}{6}$? How much more?
9. Which is most, .5, .25, or .475? Which is least?
10. Which is most, a square foot, an acre, or a square mile?
11. How do you find the average of several numbers?
12. How do you find what part of a pound 4 ounces is?

USING THE VOCABULARY OF ARITHMETIC

How many words do you know? Use each word in a sentence or make a drawing to illustrate it.

1. chart
2. account
3. change
4. bill
5. estimate
6. bales
7. schedules
8. perimeter
9. cost
10. dimension
11. wages
12. decrease
13. picture graph
14. balance
15. value
16. depth
17. produce
18. price
19. reduction
20. distance
21. increase
22. scales
23. height
24. fare
25. diameter
26. capacity
27. discount
28. salary
29. economical
30. rent

MEASURING GROWTH IN PROBLEM SOLVING

1. For the school play 320 tickets were sold at 15 cents each. How much was received for the tickets sold?

2. John worked 2.5 hours in the garden and 1.8 hours on the lawn. How long did he work in all?

3. How much less than a half hour is 15 minutes?

4. Jane's mother bought 5 yards of cloth at 58 cents a yard and 3 spools of thread at 5 cents each. How much did she spend for the cloth and thread?

5. At \$11 a ton how much does $\frac{1}{4}$ ton of coal cost?

6. What is the distance around a square flower bed if each side is $10\frac{1}{2}$ feet long?

7. It costs $\frac{1}{2}$ cent an hour to use one electric light and $\frac{2}{5}$ cent an hour to use another electric light How much more does it cost an hour to use the first light than the second light?

8. On a reading test Paul read 675 words in 3 minutes. Patty read 720 words in 3 minutes. How many more words a minute than Paul read did Patty read?

9. A farmer sold 25 bushels of potatoes at \$.84 a bushel. How many pounds of sugar can he buy with the money he received if the sugar bought in large amounts costs 6 cents a pound?

10. Jane had $5\frac{1}{4}$ yards of ribbon. She gave Ann $1\frac{1}{2}$ yards and Ora $2\frac{1}{4}$ yards. How many yards of ribbon did Jane then have?

What Your Score Means

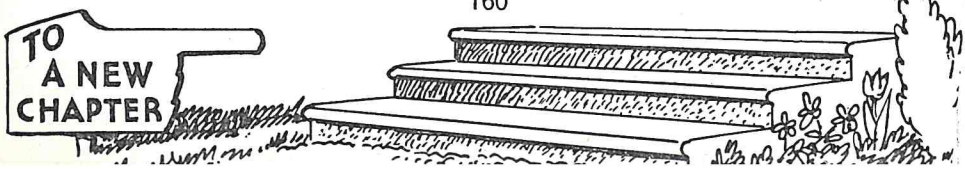
Unsatisfactory	Fair	Good	Excellent
0 1 2 3 4	5 6	7 8	9 10

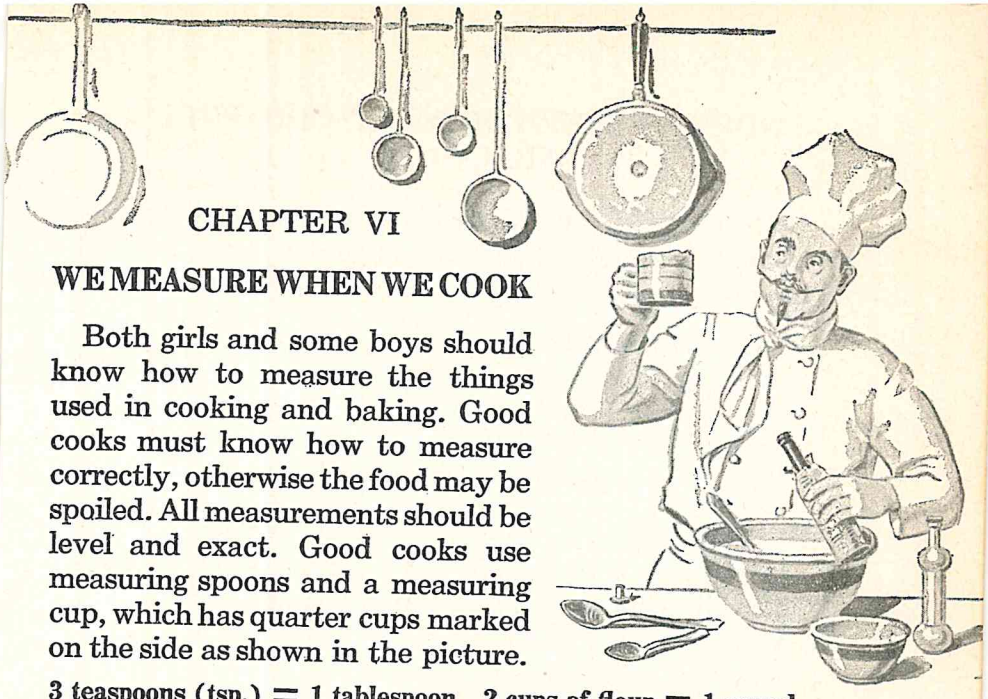
UP THE STEPS TO A NEW CHAPTER

This test will help you to find out how well you understand the arithmetic you have studied. When you copy the numbers, leave enough space for your work.

1. Reduce the following: $\frac{8}{12}$; $\frac{9}{15}$; $\frac{16}{80}$; $\frac{12}{36}$ (23)
2. Add in two ways: 6 ft. 7 in. + 9 ft. 8 in. (156)
3. Subtract 8 hr. 15 min. from 12 hr. 45 min. (156)
4. How much is $\frac{1}{4}$ of 3920? (11)
5. How much is 4343 ÷ 86? Check your answer. (14)
6. Divide 5184 by 54. Check your answer. (77)
7. How much is 17024 ÷ 28? (89)
8. Divide 15040 by 16. Check your answer. (96)
9. What is the product of 869 × 547? (58)
10. How much do 600 pounds of butter cost at \$.40 a pound? (57)
11. Multiply 458 by 906. (59)
12. Express as decimals: $4\frac{3}{10}$; $9\frac{39}{100}$; $\frac{18}{1000}$. (38)
13. Add 29.8, 786.3, 9.1, and 37.8. (42)
14. Subtract 37.689 from 48.375. Check by addition. (49)
15. Express in simplest form: $6\frac{3}{3}$; $9\frac{4}{2}$; $8\frac{6}{4}$; $7\frac{5}{3}$. (23)
16. Supply the missing numerators: $1\frac{1}{4} = \frac{?}{4}$; $3 = 2\frac{?}{3}$; $6\frac{1}{2} = 5\frac{?}{4}$; $8\frac{2}{5} = 7\frac{?}{5}$; $9\frac{1}{3} = 8\frac{?}{6}$. (117)
17. How much is $7\frac{3}{4} + 6\frac{5}{8}$? (114)
18. Add $3\frac{1}{4} + 2\frac{1}{2} + 6\frac{3}{8} + 7\frac{1}{8}$. (114)
19. Subtract $8\frac{3}{4}$ from $9\frac{1}{2}$. (144)
20. $8\frac{1}{3} - 2\frac{1}{2} = ?$ Check by addition. (148)

After your paper has been marked, correct at once any errors you made. If necessary, turn for help to the pages given at the right of the test. Be sure that you know how to work every example in the test before you go on to the next chapter.





CHAPTER VI

WE MEASURE WHEN WE COOK

Both girls and some boys should know how to measure the things used in cooking and baking. Good cooks must know how to measure correctly, otherwise the food may be spoiled. All measurements should be level and exact. Good cooks use measuring spoons and a measuring cup, which has quarter cups marked on the side as shown in the picture.

3 teaspoons (tsp.) = 1 tablespoon
4 tablespoons (tbs.) = $\frac{1}{4}$ cup
2 cups = 1 pint

2 cups of flour = 1 pound
2 cups granulated sugar = 1 pound
1 pound of butter = 2 cups

1. How many teaspoons make $\frac{1}{4}$ cup?
2. How many tablespoons make a cup?
3. How many cups of milk make a quart?
4. What part of a pound is 1 cup of flour? 1 cup of sugar? 1 cup of butter?
5. A cookbook said, "To measure $\frac{1}{2}$ cup of butter, fill a measuring cup half full of water. Then put in small lumps of butter until the water reaches the top of the cup." Tell how to measure $\frac{1}{4}$ cup of butter, using the same method.

*6. A recipe calls for 3 cups of flour. Suppose you do not have a measuring cup but you do have a scale for measuring weight. How can you use the scales to get just enough flour to make 3 cupfuls?

READINESS TEST FOR MULTIPLICATION OF FRACTIONS

In this chapter you will study about multiplication of fractions. This test will help you to find out if you are ready for the new work.

I. Reduce these fractions to lowest terms:

$\frac{6}{12}, \frac{8}{10}, \frac{15}{25}, \frac{18}{30}, \frac{20}{40}$

II. Express in simplest form:

$\frac{25}{2}, \frac{48}{4}, \frac{7}{1}, \frac{48}{30}, \frac{90}{25}, 6\frac{6}{4}$

III. Using addition instead of multiplication:

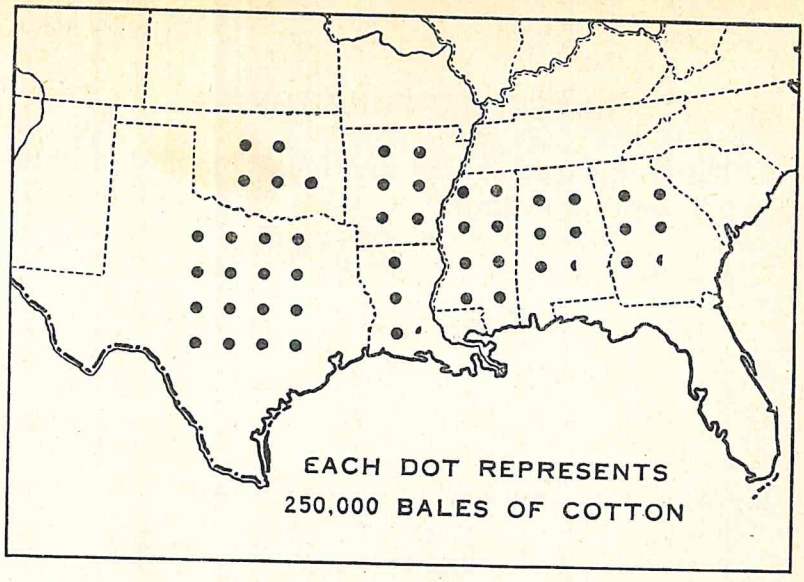
1. How much is 4 times $\frac{1}{4}$? Find out by adding four $\frac{1}{4}$'s.
2. Use addition to find how much 3 times $\frac{2}{3}$ is.
3. How much is 5 times $\frac{3}{8}$?
4. How much is 3 times $1\frac{1}{4}$?

IV. Division by 2, 3, 4, and 5.

1. What do we mean by odd numbers? by even numbers?
2. Which of these numbers can be divided evenly by 2?
   3 6 8 10 12 14 15 24 35 48 60
3. Which numbers above can be divided evenly by 3?
4. Which numbers above can be divided evenly by 4?
5. Which of these numbers can be divided evenly by 5? How can you tell?

V. Changing the form of fractions:

1. Change to twelfths: $\frac{1}{2}, \frac{1}{3}, \frac{2}{3}, \frac{5}{6}$.
2. Supply the missing numerators: $1\frac{1}{4} = \frac{?}{4}$; $1\frac{2}{3} = \frac{?}{3}$.
3. Does $\frac{16}{5}$ equal $3\frac{1}{5}$?
4. Does $2\frac{1}{2}$ equal $\frac{5}{2}$?
5. How many quarter circles are there in 3 circles divided into fourths? $3 = \frac{?}{4}$



DOTS THAT TELL FACTS

The dots on the map help us to tell quickly how much cotton is produced in each of the states. The more dots there are on the map of a state, the more cotton is produced there. (Each dot on this map represents 250,000 bales of cotton.)

1. In which state is the most cotton produced?
2. In which state is the least cotton produced?
3. How many dots are there on Texas?
4. About how many bales of cotton were produced in Texas?
5. About how many bales of cotton were produced in Mississippi? in Louisiana? in Arkansas? in Oklahoma?

*6. South Carolina produced 800 thousand bales of cotton. How many dots would you place on a map of South Carolina to show this crop if each dot stands for 100 thousand bales?

*7. Make an outline map of South Carolina and show on it by circles the amount of cotton produced there.

LET'S TELL THE STORIES

1. These two pictures tell multiplication stories. Show that the stories are correct.

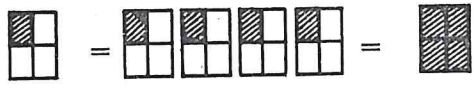
a. $2 \times$ $= \frac{1}{2} = \frac{2}{2} = 1$

b. $3 \times$ $= \frac{1}{3} = \frac{3}{3} = 1$

2. What story does each of these pictures tell?

a. $3 \times$

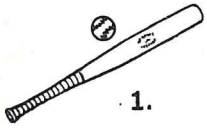
b. $3 \times$

c. $4 \times$ 

Draw pictures like those above showing these examples:

3. $4 \times \frac{1}{4} = \frac{4}{4} = 1$
4. $4 \times \frac{1}{2} = \frac{4}{2} = 2$
5. $3 \times \frac{2}{3} = \frac{6}{3} = 2$
6. $2 \times \frac{3}{4} = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$

LET'S PRACTICE



	a	*b*	*c*	*d*	*e*
1.	$5\frac{3}{4}$ $+6\frac{3}{4}$	$35\overline{)337}$	9 $-5\frac{3}{8}$	$7\frac{1}{2}$ $+5\frac{1}{2}$	$25\overline{)800}$
2.	587 $\times 680$	$7\frac{5}{8}$ $-2\frac{5}{8}$	376 $\times 400$	$46\overline{)1481}$	$6\frac{1}{4}$ $-2\frac{3}{4}$
3.	37.596 -8.479	$6\frac{1}{8}$ $+5\frac{3}{8}$	$85\overline{)6885}$	829 $\times 705$	$73\overline{)2847}$

MULTIPLYING FRACTIONS BY WHOLE NUMBERS

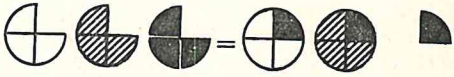
1. Mary, Arthur, and John each had $\frac{3}{4}$ pound of candy. How much candy did they have in all?

You can find the amount by addition.

THINK: $\frac{3}{4}$ lb. + $\frac{3}{4}$ lb. + $\frac{3}{4}$ lb. = ?

2. Because each of the children had the same amount of candy, you can find the answer by multiplication.

THINK: $3 \times \frac{3}{4}$ lb. = ?



$3 \times \frac{3}{4} = \frac{3 \times 3}{4} = \frac{9}{4}$ lb.

Three times three fourths is nine fourths or $2\frac{1}{4}$.

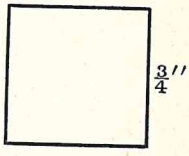
$\frac{9}{4}$ lb. = $2\frac{1}{4}$ lb., the same as your answer to problem 1.

3. How many fourths is four times three fourths? six times one fourth?

4. Find the distance around the square at the right, first by addition, then by multiplication

THINK: $\frac{3}{4}''$ + $\frac{3}{4}''$ + $\frac{3}{4}''$ + $\frac{3}{4}''$ = ? in.

$4 \times \frac{3}{4} = \frac{4 \times 3}{4}$ = ? in.



5. Study the following examples until you understand how each one is worked. Then copy, and work them with your book closed.

a. $3 \times \frac{2}{5} = \frac{3 \times 2}{5} = \frac{6}{5} = 1\frac{1}{5}$ *b.* $4 \times \frac{5}{6} = \frac{4 \times 5}{6} = \frac{20}{6} = 3\frac{2}{6} = 3\frac{1}{3}$

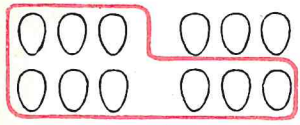
c. $2 \times \frac{1}{4} = \frac{2 \times 1}{4} = \frac{2}{4} = \frac{1}{2}$ *d.* $8 \times \frac{1}{8} = \frac{8 \times 1}{8} = \frac{8}{8} = 1$

To multiply a fraction by a whole number, multiply the numerator by the whole number, and write the product over the denominator. Reduce the result to simplest form.

Multiply:

	a	*b*	*c*	*d*	*e*
6.	$3 \times \frac{3}{5} =$	$4 \times \frac{3}{4} =$	$3 \times \frac{3}{4} =$	$5 \times \frac{1}{2} =$	$6 \times \frac{2}{3} =$
7.	$6 \times \frac{3}{4} =$	$4 \times \frac{5}{6} =$	$6 \times \frac{3}{8} =$	$4 \times \frac{1}{8} =$	$3 \times \frac{1}{6} =$
8.	$5 \times \frac{1}{5} =$	$7 \times \frac{5}{8} =$	$9 \times \frac{2}{3} =$	$2 \times \frac{1}{2} =$	$3 \times \frac{5}{6} =$

MULTIPLYING WHOLE NUMBERS BY FRACTIONS



1. Jack's mother told him that she had $\frac{3}{4}$ dozen eggs. Here is how Jack found the number of eggs she had.

He said "$\frac{3}{4}$ dozen = $\frac{3}{4}$ of 12."
Jack knew that $\frac{1}{4}$ doz. = $\frac{1}{4}$ of 12, or 3.
He knew that $\frac{3}{4}$ doz. is 3 times as much as $\frac{1}{4}$ doz.
So he knew that his mother had 3 × 3 eggs, or 9 eggs.

2. How much is $\frac{3}{4} \times 20$?

THINK: $\frac{1}{4} \times 20$ is the same as $\frac{1}{4}$ of 20, or 5.
So $\frac{3}{4}$ of 20 = 3 × 5 = 15.
A quick way to find $\frac{3}{4} \times 20$ is shown below:

$\frac{3}{4} \times 20 = \frac{3 \times 20}{4} = \frac{60}{4} = 15$

Multiply 20 by 3. Write 60 over 4 and then reduce the fraction.

3. Use this method to find $\frac{3}{4} \times 24$; $\frac{3}{8} \times 32$; $\frac{3}{5} \times 40$.

4. You know that 4 × 2 = 2 × 4. Show that $20 \times \frac{3}{4}$ is equal to $\frac{3}{4} \times 20$.

THINK: $20 \times \frac{3}{4} = \frac{20 \times 3}{4} = \frac{60}{4} = 15$
$\frac{3}{4} \times 20 = \frac{3 \times 20}{4} = \frac{60}{4} = 15$

5. Show that the product of $12 \times \frac{3}{4}$ is the same as the product of $\frac{3}{4} \times 12$.

6. Study the examples below. Then copy, and work them with your book closed.

a. $\frac{3}{4} \times 15 = \frac{3 \times 15}{4} = \frac{45}{4} = 11\frac{1}{4}$
b. $2 \times \frac{3}{8} = \frac{2 \times 3}{8} = \frac{6}{8} = \frac{3}{4}$
c. $\frac{3}{4} \times 10 = \frac{3 \times 10}{4} = \frac{30}{4} = 7\frac{2}{4} = 7\frac{1}{2}$
d. $\frac{1}{8} \times 8 = \frac{1 \times 8}{8} = \frac{8}{8} = 1$

Multiply:

	a	*b*	*c*	*d*
7.	$\frac{2}{5} \times 10 =$	$\frac{3}{4} \times 11 =$	$\frac{2}{3} \times 4 =$	$\frac{3}{8} \times 5 =$
8.	$\frac{1}{3} \times 15 =$	$\frac{3}{8} \times 20 =$	$\frac{3}{4} \times 14 =$	$\frac{5}{6} \times 12 =$
9.	$16 \times \frac{3}{4} =$	$\frac{3}{5} \times 10 =$	$\frac{3}{4} \times 16 =$	$9 \times \frac{4}{5} =$
10.	$4 \times \frac{1}{4} =$	$\frac{2}{3} \times 3 =$	$\frac{1}{2} \times 2 =$	$4 \times \frac{3}{4} =$

BUYING AND SELLING CANDY

1. Mary wanted to fill 8 boxes putting $\frac{1}{2}$ pound of candy in each box. How many pounds of candy will she need?

2. Ann filled 7 half-pound boxes with the candy she made. How many pounds of candy did Ann make?

3. Mr. Jones bought 3 half-pound boxes of candy and 6 one-quarter pound boxes of candy. How much candy did he buy in all?

4. Mary plans to sell her candy for 40 cents a pound. How much should she ask for $\frac{1}{2}$ pound of candy?

5. Mrs. Brown wants $\frac{3}{4}$ pound of candy. How many ounces should Mary give her?

6. How much should Mrs. Brown pay Mary for $\frac{3}{4}$ pound of candy?

7. At noon Mary had only 8 ounces of candy left. How much should she receive for the candy at 40 cents a pound?

8. In all the children took in $8. How many half dollars are there in $8? How many quarters?

*9. Find a recipe for making candy Find the cost of making 4 pounds of the candy.

SHALL WE MAKE OR BUY OUR ICE CREAM?

The sixth grade was planning a party. They decided to have ice cream and cookies for refreshments. They wondered which would be cheaper, to buy the ice cream at the store at 40 cents a quart or to buy the things of which the ice cream is made and to make the ice cream themselves. There were 32 children in the class. They thought that 1 quart of ice cream would be enough for 8 children.

1. How many quarts of ice cream did they need?

2. How much would the ice cream cost if bought at the store?

3. A committee of the children found the recipe for ice cream given below. It was for 2 quarts of ice cream.

2 cups of milk	1 cup of sugar
1 quart of thin cream	3 eggs
2 tablespoons vanilla	$\frac{1}{8}$ teaspoon salt

Make a list of the items in the recipe and show how much of each thing would be needed for enough ice cream for the 32 children in the class.

4. The children found that the prices of these things were not the same at all of the stores they visited. The lowest prices they found were the following:

Milk, 12¢ a qt.	Eggs, 40 cents a dozen
Cream, 45¢ a qt.	Sugar, 6 cents a pound
Salt, 8¢ a box	Vanilla, 10 cents a small bottle

Using these prices find the cost of the things they would have to buy if they made the ice cream themselves.

5. Of which things would they have to buy more than they would need?

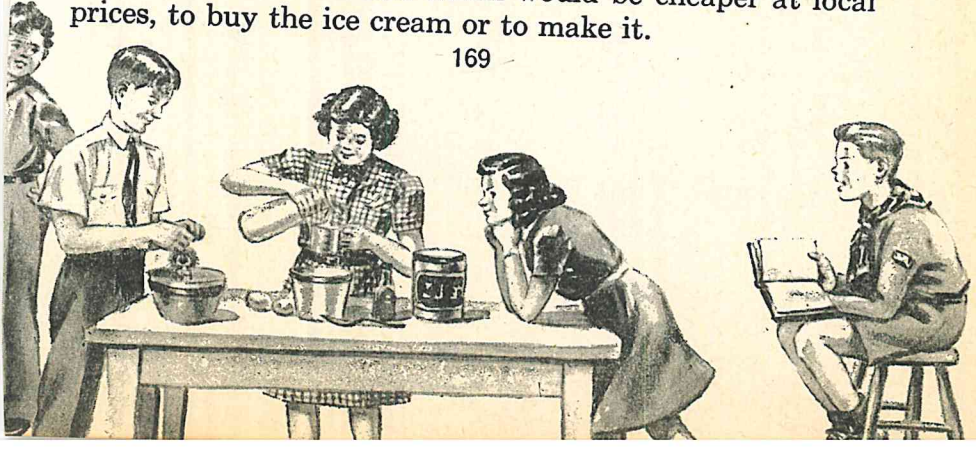
6. One boy said, "We can use Mr. Smith's freezer, but do not forget that we must buy ice with which to freeze the ice cream, and some rock salt." They estimated that they would need 5 cents worth of rock salt and 25 pounds of ice. The ice sold at 40 cents a hundred pounds if they bought the ice at a "cash and carry" store. It would cost 30 cents for the ice if it was delivered at the school. How much would they save if they bought the ice at the "cash and carry" store? Why was there this difference in price? Why is rock salt needed?

7. Find the total cost of all of the things the children would have to buy if they made the ice cream themselves.

8. Which was cheaper for the children, to buy the ice cream at the store, or to make it themselves?

*9. The ice cream factory not only buys the things needed to make ice cream but also pays the wages of the men who work there. Suppose that it would take two boys $1\frac{1}{2}$ hours to freeze the ice cream. If the class had to pay them for their work, how much would the ice cream cost? Let the class decide how much it might be fair to pay the boys for their work.

*10. Find local prices of ice cream. Also find the prices of the things listed in the recipe for ice cream and for the ice and rock salt. Then find which would be cheaper at local prices, to buy the ice cream or to make it.



MULTIPLYING WITH MIXED NUMBERS

1. Alice drinks $1\frac{1}{4}$ glasses of milk at each meal. How much milk does she drink in 2 meals?

$2 \times 1\frac{1}{4} = 1\ \frac{1}{4} + 1\ \frac{1}{4} = 2\frac{1}{2}$

$$\begin{array}{r} 1\frac{1}{4} \\ \times 2 \\ \hline \frac{1}{2}\ (2 \times \frac{1}{4}) \\ 2\ (2 \times 1) \\ \hline 2\frac{1}{2} \end{array}$$

THINK: $1\frac{1}{4} \times 2 = ?$
First multiply $\frac{1}{4}$ by 2. This gives $\frac{1}{2}$. Write $\frac{1}{2}$ as shown at the left.
Then multiply 1 by 2. This gives 2. Write the 2 as shown at the left.
Add $\frac{1}{2}$ and 2. She drinks $2\frac{1}{2}$ glasses of milk.

2. Study the work below. Then copy the examples, and work them with your book closed.

a.
$$\begin{array}{r} 12\frac{1}{2} \\ 5 \\ \hline 2\frac{1}{2}\ (5 \times \frac{1}{2}) \\ 60\ (5 \times 12) \\ \hline 62\frac{1}{2} \end{array}$$

b.
$$\begin{array}{r} 8 \\ 6\frac{1}{4} \\ \hline 2\ (\frac{1}{4} \times 8) \\ 48\ (8 \times 6) \\ \hline 50 \end{array}$$

c.
$$\begin{array}{r} 3 \\ 6\frac{1}{8} \\ \hline \frac{3}{8}\ (\frac{1}{8} \times 3) \\ 18\ (6 \times 3) \\ \hline 18\frac{3}{8} \end{array}$$

3. Prove by addition that the answers to the examples in 2 are correct.

4. Helen needs $2\frac{1}{2}$ yards of cloth for each dress. How many yards does she need for 4 dresses? for 5 dresses?

Multiply. Go over your work carefully to check it.

	a	*b*	*c*	*d*	*e*	*f*
5.	$7\frac{1}{4} \times 4$	$5\frac{1}{2} \times 8$	$6\frac{3}{4} \times 4$	$4\frac{1}{8} \times 6$	$8\frac{1}{2} \times 5$	$4\frac{1}{8} \times 5$
6.	$4\frac{3}{4} \times 4$	$5\frac{3}{8} \times 4$	$7\frac{1}{5} \times 3$	$6\frac{1}{2} \times 6$	$3\frac{5}{8} \times 4$	$7\frac{1}{3} \times 2$
7.	$8\frac{1}{6} \times 4$	$6\frac{1}{8} \times 4$	$9\frac{3}{5} \times 6$	$8\frac{3}{5} \times 10$	$6\frac{1}{12} \times 8$	$9\frac{3}{10} \times 2$

HOW MUCH SHOULD WE PAY?

1. How much do 4 pencils cost at 2 for 5 cents?
There are two ways to solve this problem:

Method I. At 2 for 5¢, the cost of 1 pencil is $5¢ \div 2 = 2\frac{1}{2}¢$.
So 4 pencils cost $4 \times 2\frac{1}{2}¢$, or 10¢.

Method II. THINK: 4 pencils is 2 times 2 pencils.
So 4 pencils cost 2 times as much as 2 pencils cost, or 10 cents.

2. At 2 for 5 cents how much do 6 pencils cost? 8 pencils? 20 pencils?

3. At 3 for 10 cents how much do 6 oranges cost? 9 oranges? a dozen oranges?

4. At 4 for 30 cents how much do 8 cans of corn cost? a dozen cans?

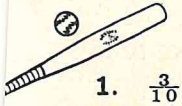
5. Joe saw the sign at the right. He wanted only 1 can of tomatoes. The clerk said, "The price is $8\frac{1}{3}$ cents a can when you buy 3 cans, but we count the fraction of a cent as a whole cent when you buy only 1 can." How much did Joe have to pay for one can?

Tomatoes
3 cans for 25¢

6. Find the cost of one of each of the following:
   a. corn, 3 cans for 29¢ *b.* cookies, 2 boxes for 25¢
   c. peas, 4 cans for 58¢ *d.* 3 grapefruit for 10¢

*7. Should the clerk have asked Joe to pay only 8 cents?

LET'S PRACTICE



	a	*b*	*c*	*d*
1.	$\frac{3}{10} \times 25 =$	$\frac{5}{8} \times 12 =$	$\frac{1}{4} \times 3 =$	$6 \times \frac{1}{4} =$
2.	$5 \times 2\frac{1}{2} =$	$\frac{1}{2} \times 6 =$	$2\frac{1}{2} \times 7 =$	$10 \times 4\frac{1}{5} =$
3.	$7 \times \frac{2}{3} =$	$\frac{1}{8} \times 2 =$	$8 \times \frac{5}{6} =$	$\frac{1}{4} \times 8 =$
4.	$6\frac{1}{2} \times 4 =$	$8\frac{3}{4} \times 5 =$	$\frac{3}{4} \times 6 =$	$9\frac{2}{3} \times 6 =$

DIAGNOSTIC TEST IN MULTIPLICATION OF FRACTIONS

This test will help you to find out how well you have learned to multiply fractions and whole numbers.

	a	*b*	*c*	*d*	
1.	$4 \times \frac{2}{3} =$	$3 \times \frac{2}{5} =$	$7 \times \frac{3}{4} =$	$5 \times \frac{1}{6} =$	(165)
2.	$6 \times \frac{3}{4} =$	$8 \times \frac{1}{2} =$	$6 \times \frac{2}{3} =$	$4 \times \frac{1}{4} =$	(165)
3.	$\frac{2}{5} \times 3 =$	$\frac{1}{4} \times 3 =$	$\frac{3}{4} \times 5 =$	$\frac{7}{8} \times 9 =$	(166)
4.	$\frac{3}{4} \times 10 =$	$\frac{7}{8} \times 16 =$	$\frac{1}{6} \times 4 =$	$\frac{4}{5} \times 5 =$	(166)
5.	$3\frac{1}{2}$ $\times 4$	$6\frac{1}{3}$ $\times 5$	$7\frac{1}{6}$ $\times 6$	$3\frac{5}{8}$ $\times 4$	(170)

If you have errors in only one or two examples in a row, correct your work at once. If you have errors in three or four examples in a row, turn back for help to the pages indicated at the end of the row. Then rework the examples in the test. If you need more help, ask your teacher to help you.

Checking Up

Work the first two examples in each row in the tests on addition and subtraction of fractions on pages 130 and 133.

Work the first example in each row on page 119.

*INTERESTING FACTS TO FIND OUT

If you do not need more practice on the kinds of examples in the tests above, you may select one of the topics given below and prepare a special report for the class.

1. What some dot maps found in geography books tell.
2. The work of Better Business Bureaus.
3. How cloth is measured at the store.
4. Who pays for building roads? How much does your state spend for the building of roads?

THE RADIO IS A BIG BUSINESS

1. In a recent year America owned $\frac{2}{3}$ of the radios in the world. What part was owned in other countries?

2. In 29 million homes there was at least one radio. Write twenty-nine million in figures.

3. In a recent year the American people spent 200 million dollars for batteries and the same amount for electricity to run their radios. How much do these two numbers total?

4. In a recent year America's broadcasting companies sold \$190,000,000 worth of broadcasting time. A half hour on a coast-to-coast broadcast cost on the average \$12,000. This was at the rate of how much an hour?

5. Small stations sold an average of about $5\frac{1}{4}$ hours a day. How many hours of time did they sell during a week?

6. Large stations sold about $7\frac{1}{2}$ hours a day. How many hours more a day was this than the time sold a day by small stations?

7. About 47,000 people were employed whole or part time by radio. There were about 4000 announcers. How many were employed who were not announcers?

*8. Why are our people willing to spend so much money for radios?

MULTIPLYING BY LARGER NUMBERS

1. How much is 2000 × 8?
   THINK: 2 thousand × 8 = 16 thousand, or 16,000.
2. Write the products:

   a. 2000 × 4 = *b.* 1000 × 27 = *c.* 7000 × 275 =
   d. 4000 × 7 = *e.* 1000 × 40 = *f.* 8000 × 203 =

3. At $1,428 each how much would 3,126 automobiles sell for?

$$\begin{array}{r} \$1428 \\ \times 3126 \\ \hline 8568 \\ 28560 \\ 142800 \\ 4284000 \\ \hline \$4463928 \end{array}$$

To multiply by four-place numbers, proceed in the same way as in multiplying by three-place numbers.
First multiply 1428 by 6.
Then multiply 1428 by 20.
Then multiply 1428 by 100.
Then multiply 1428 by 3000.
Find the sum.
They would sell for $4,463,928.

4. Show that the products below are correct:

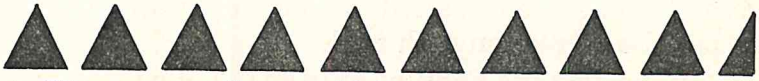
a.	*b.*	*c.*
2167	3105	7085
×4008	×1200	×6980
17336	621000	566800
8668000	3105000	6376500
8685336	3726000	42510000
		49453300

5. Copy the examples in 3 and 4 without the work and find the products. Compare your work with the work given above.
6. How much is 1000 × 52? 1000 × 176? 1000 × 408?
7. Can you give a rule for multiplying quickly a number by 10? by 100? by 1000?

8. 4976 × 8754 =
9. 8523 × 9268 =
10. 6700 × 9847 =
11. 9080 × 8967 =
12. 7964 × 1963 =
13. 2835 × 7534 =

*PICTURING THE WORLD'S PRODUCTS

Look at the piles of coal below. Each pile represents 50 million tons of coal. How many million tons of coal do all of the piles stand for? This is equal to the coal produced each year in the United States.



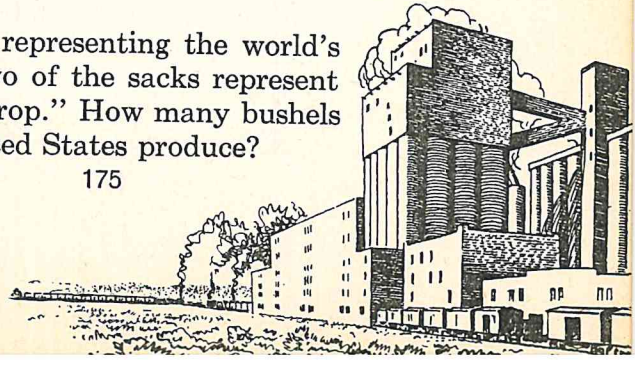
1. How many piles would it take to picture 800 million tons of coal, the amount produced in the rest of the world? THINK: $800 \div 50 = ?$

2. Draw a graph showing in one line of round dots the amount of coal produced in the United States. Write before the line of dots, "United States." Below this line make a row of round dots showing the amount of coal produced in the rest of the world. Before the second line of dots write, "Rest of World."

3. The United States in a recent year produced 1300 (13 hundred) million barrels of oil and the rest of the world about 600 million barrels. If you let a barrel represent 100 million barrels of oil, how many barrels would you have to draw to represent the oil produced in the United States? in the rest of the world?

4. Draw ten sacks in a row across your paper to picture the amount of wheat produced in the world. Below this line of sacks write "World's Wheat Production." If 4,850 million bushels of wheat were produced in the world, how many bushels does each of the ten sacks you drew stand for?

5. Of the 10 sacks representing the world's wheat production, two of the sacks represent the "United States Crop." How many bushels of wheat did the United States produce?



PRACTICE WITH FRACTIONS

You should be able to find the answers to the examples in each set in less than the time allowed. Copy the examples before counting time. Always check your work. Repeat each set of examples several times to increase your speed of work. Keep a record of your time and the number of examples correct on each trial.

Changing the Form of Fractions (5 minutes)

1. Express the following fractions in simplest form:
   $\frac{2}{4}$ $\frac{10}{12}$ $\frac{6}{8}$ $\frac{2}{2}$ $\frac{4}{4}$ $\frac{6}{2}$ $\frac{7}{3}$ $\frac{9}{6}$
2. Supply the missing numerators:
   $\frac{3}{4} = \frac{\quad}{8}$ $\frac{1}{2} = \frac{\quad}{4}$ $\frac{2}{3} = \frac{\quad}{6}$, or $\frac{\quad}{9}$, or $\frac{\quad}{12}$
3. Express these numbers in simplest form:
   $4\frac{2}{4}$ $5\frac{4}{6}$ $6\frac{2}{2}$ $7\frac{4}{4}$ $8\frac{6}{3}$ $9\frac{3}{2}$ $7\frac{6}{4}$
4. Find the missing numerators:
   a. $5\frac{1}{2} = 5\frac{\quad}{4} = 4\frac{\quad}{4}$ *b.* $1\frac{1}{2} = 1\frac{\quad}{4} = \frac{\quad}{4}$ *c.* $2 = 1\frac{\quad}{4}$

Adding Fractions (12 minutes)

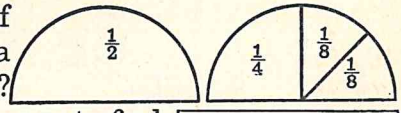
	a	*b*	*c*	*d*	*e*	*f*
1.	$\frac{1}{6}$ $\frac{1}{6}$	$\frac{2}{3}$ $\frac{2}{3}$	$3\frac{3}{4}$ $\frac{1}{4}$	$6\frac{7}{8}$ $4\frac{5}{8}$	$\frac{1}{2}$ $\frac{3}{8}$	$3\frac{1}{6}$ $2\frac{1}{2}$
2.	$3\frac{3}{4}$ $7\frac{1}{2}$	$6\frac{7}{8}$ $5\frac{1}{2}$	$4\frac{1}{2}$ $2\frac{1}{4}$ $6\frac{1}{4}$	$7\frac{1}{8}$ $5\frac{3}{8}$ $4\frac{1}{2}$	$6\frac{3}{4}$ $5\frac{1}{2}$ $3\frac{1}{8}$	$7\frac{1}{2}$ $6\frac{1}{4}$ $7\frac{7}{8}$

Subtracting Fractions (12 minutes)

1.	$\frac{7}{8}$ $\frac{3}{8}$	$6\frac{1}{3}$ $4\frac{1}{3}$	$\frac{1}{2}$ $\frac{1}{4}$	$8\frac{1}{4}$ $2\frac{3}{4}$	$1\frac{1}{8}$ $\frac{3}{8}$	9 $3\frac{2}{5}$
2.	7 $6\frac{1}{2}$	$\frac{3}{4}$ $\frac{3}{8}$	$6\frac{1}{4}$ $2\frac{1}{8}$	$5\frac{1}{2}$ $2\frac{3}{4}$	$6\frac{1}{8}$ $4\frac{1}{2}$	$6\frac{2}{3}$ $4\frac{1}{6}$

MULTIPLYING FRACTIONS BY FRACTIONS

1. Here are two equal half circles. You can see that $\frac{1}{2}$ of a half circle is $\frac{1}{4}$ circle. $\frac{1}{2}$ of $\frac{1}{2}$ = ?



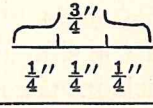
To find $\frac{1}{2}$ of $\frac{1}{2}$ is the same as to find $\frac{1}{2} \times \frac{1}{2}$. You can multiply $\frac{1}{2}$ by $\frac{1}{2}$ as shown in the box at the right.

$$\frac{1}{2} \times \frac{1}{2} = \frac{1 \times 1}{2 \times 2} = \frac{1}{4}$$

2. You can see from the drawing at the top of the page that $\frac{1}{2}$ of $\frac{1}{4}$ circle is $\frac{1}{8}$ circle. The work at the right shows how to find $\frac{1}{2} \times \frac{1}{4}$ by multiplication.

$$\frac{1}{2} \times \frac{1}{4} = \frac{1 \times 1}{2 \times 4} = \frac{1}{8}$$

3. Draw a line $\frac{3}{4}$ inch long. Divide it into three equal parts. How long is $\frac{1}{3}$ of the line? How long is $\frac{2}{3}$ of the line? You can see that $\frac{2}{3}$ of $\frac{3}{4}$ inch = $\frac{1}{2}$ inch. To find $\frac{2}{3}$ of $\frac{3}{4}$ without using a drawing, you can find $\frac{2}{3} \times \frac{3}{4}$ as shown at the right.



$$\frac{2}{3} \times \frac{3}{4} = \frac{2 \times 3}{3 \times 4} = \frac{6}{12} = \frac{1}{2}$$

You can use this method to multiply any two fractions. Complete the work below:

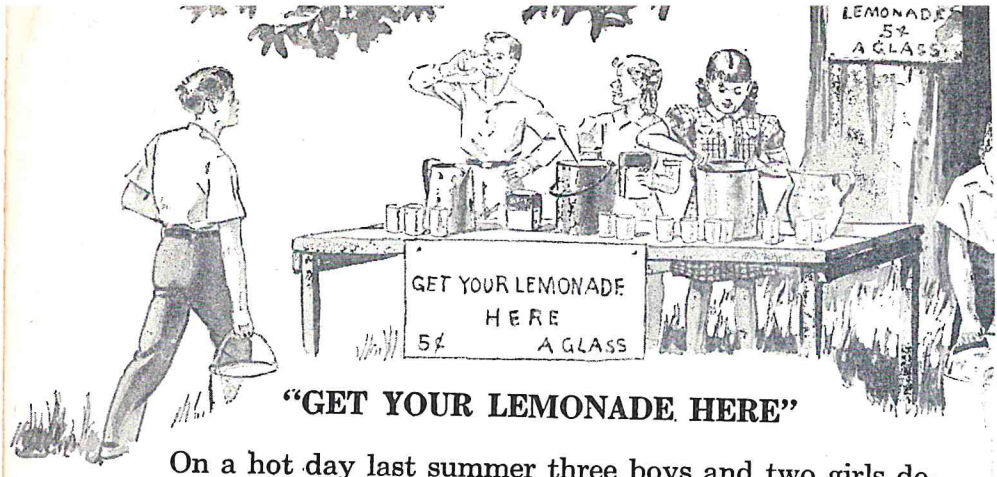
4. $\frac{2}{3} \times \frac{1}{4} = \frac{2 \times 1}{3 \times 4} = ?$

5. $\frac{3}{4} \times \frac{4}{9} = \frac{3 \times 4}{4 \times 9} = \frac{12}{36} = ?$

To multiply two fractions, write the product of the numerators as the numerator of the answer, and the product of the denominators as the denominator of the answer. Be sure to reduce the answer to lowest terms.

Find the products of these fractions. Reduce them to lowest terms.

	a	*b*	*c*	*d*	*e*
6.	$\frac{1}{4} \times \frac{1}{4} =$	$\frac{1}{3} \times \frac{1}{2} =$	$\frac{1}{3} \times \frac{1}{3} =$	$\frac{1}{2} \times \frac{1}{2} =$	$\frac{1}{4} \times \frac{1}{2} =$
7.	$\frac{2}{3} \times \frac{1}{3} =$	$\frac{2}{5} \times \frac{2}{3} =$	$\frac{3}{4} \times \frac{3}{5} =$	$\frac{1}{2} \times \frac{3}{4} =$	$\frac{3}{4} \times \frac{5}{8} =$
8.	$\frac{3}{4} \times \frac{5}{6} =$	$\frac{5}{8} \times \frac{4}{5} =$	$\frac{2}{3} \times \frac{3}{4} =$	$\frac{2}{5} \times \frac{5}{6} =$	$\frac{3}{5} \times \frac{5}{6} =$
9.	$\frac{5}{6} \times \frac{1}{3} =$	$\frac{4}{5} \times \frac{5}{6} =$	$\frac{7}{8} \times \frac{2}{5} =$	$\frac{5}{6} \times \frac{6}{7} =$	$\frac{1}{2} \times \frac{4}{9} =$



"GET YOUR LEMONADE HERE"

On a hot day last summer three boys and two girls decided that they would try to earn some money by selling lemonade. They decided to build a stand under a large tree at the side of the road. The boys made the stand while the girls prepared the lemonade.

The girls found this recipe for 1 quart of lemonade:

1 large lemon

$\frac{1}{2}$ cup of sugar ($\frac{1}{4}$ lb.)

1. The girls wanted to buy enough lemons and sugar to make two gallons of lemonade. How many lemons should they buy? How much sugar?

2. The price of lemons was 33 cents a dozen. How much did the lemons they needed cost? Their mother loaned them the money, which they promised to repay after they had sold the lemonade.

3. The price of sugar was 6 cents a pound. How much did the lemons and sugar cost?

4. To keep the lemonade cool they had to pay 10 cents for some ice. They broke two glasses, for which they had to pay the girls' mother 5 cents each. They spent 6 cents for some paint to use in making signs for the stand. Including the cost of the lemonade, how much did they spend in all that day?

5. Allowing 4 glasses of lemonade to the quart, how much would the children get in all for the 2 gallons of lemonade at 5 cents a glass?

6. These five children began working on the lemonade sale at 9 o'clock and worked until 1 o'clock that afternoon. During that time they sold in all 28 glasses of lemonade. How many did they sell on the average in an hour?

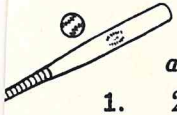
7. After the children had paid all of their expenses, how much money did they have left?

8. If they shared equally the money that was left, how much did each one receive?

9. The children had really worked quite hard to sell their lemonade. How much did each child make for each of the 4 hours he had worked? How much more than this do men and women earn an hour?

*10. While they were selling the lemonade, the city health officer happened to pass by. He asked them if they were keeping their lemonade well covered and were washing the glasses after each sale. Why were these things necessary? In most cities, places that sell refreshments such as lemonade must have licenses. Why is this required of them? Find out if local restaurants have licenses and how much these licenses cost.

LET'S PRACTICE



	a	*b*	*c*	*d*	*e*	*f*
1.	$2\frac{1}{4}$ $+3\frac{1}{4}$	$6\frac{3}{4}$ $-5\frac{1}{4}$	$5\frac{1}{2}$ $+4\frac{1}{4}$	9 $-7\frac{1}{2}$	$6\frac{7}{8}$ $+3\frac{5}{8}$	$8\frac{5}{6}$ $-2\frac{1}{3}$
2.	$16\frac{1}{4}$ $+9\frac{3}{4}$	$9\frac{1}{2}$ $+6\frac{2}{3}$	$9\frac{1}{3}$ $-7\frac{1}{2}$	$7\frac{3}{4}$ $+6\frac{7}{8}$	$8\frac{1}{4}$ $+3\frac{5}{6}$	$8\frac{1}{4}$ $-5\frac{1}{2}$

3. $6.8 + 27.5 + 278.4 =$

4. $32.764 - 4.973 =$

5. $23.97 + 4.96 + .96 =$

6. $984.2 - 32.7 =$

A SHORT WAY TO MULTIPLY FRACTIONS

In working the example $\frac{3}{4} \times \frac{5}{6}$, you must multiply, and then reduce the answer.

Multiply before dividing: $\frac{3}{4} \times \frac{5}{6} = \frac{3 \times 5}{4 \times 6} = \frac{15}{24} = \frac{5}{8}$

How do you reduce $\frac{15}{24}$ to $\frac{5}{8}$? You may multiply the two fractions and then divide both numerator and denominator by the same number, as shown above.

Divide before multiplying: $\frac{3}{4} \times \frac{5}{6} = \frac{\overset{1}{\cancel{3}}}{4} \times \frac{5}{\underset{2}{\cancel{6}}} = \frac{1 \times 5}{4 \times 2} = \frac{5}{8}$

We divide the 3 of $\frac{3}{4}$ and the 6 of $\frac{5}{6}$ by 3, and write the results as shown.

It is often easier to first divide one numerator and one denominator by the same number as in reduction and then multiply as shown above. The numbers divided are **cancelled** to show that they have been divided.

1. Which of the following denominators can be divided by the numerator of the first fraction?

$\frac{2}{3} \times \frac{}{4}, \frac{}{6}, \frac{}{7}, \frac{}{8}, \frac{}{9}, \frac{}{12}$

2. Which of the following numerators can be divided by the denominator of the first fraction?

$\frac{2}{3} \times \frac{3}{}, \frac{5}{}, \frac{6}{}, \frac{8}{}, \frac{9}{}, \frac{15}{}$

3. Explain the division and multiplication in the examples below.

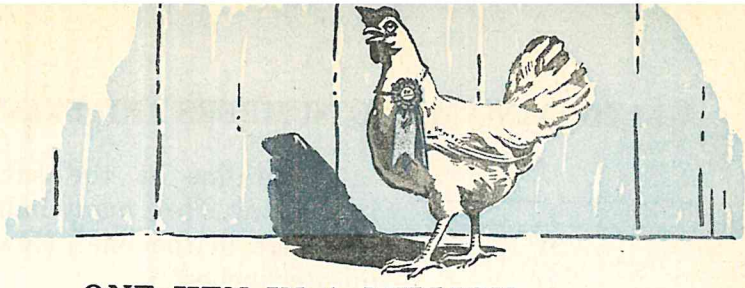
a. $\frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{8}}} \times \frac{3}{\underset{5}{\cancel{10}}} = \frac{1 \times 3}{1 \times 5} = \frac{3}{5}$ *b.* $\frac{\overset{1}{\cancel{2}}}{\underset{3}{\cancel{8}}} \times \frac{2}{\underset{1}{\cancel{4}}} = \frac{1 \times 2}{3 \times 1} = \frac{2}{3}$

4. Work the examples in 3, not using division before you multiply. Which way seems easier? Why?

Find the products. Divide before you multiply:

5. $\frac{4}{5} \times \frac{7}{8} =$ 7. $\frac{8}{9} \times \frac{9}{16} =$ 9. $\frac{3}{10} \times \frac{5}{6} =$ 11. $\frac{7}{12} \times \frac{15}{21} =$

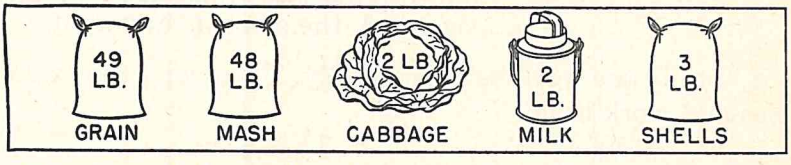
6. $\frac{5}{6} \times \frac{9}{10} =$ 8. $\frac{2}{3} \times \frac{7}{8} =$ 10. $\frac{12}{25} \times \frac{15}{16} =$ 12. $\frac{5}{8} \times \frac{16}{25} =$



ONE HEN IN A MILLION

This is the true story of a prize hen that weighed only 4.6 pounds. The 300 eggs she laid in one year weighed in all 34.5 pounds, and sold on the average for 28¢ a dozen.

Her food cost $11\frac{1}{2}$ cents for each dozen eggs she laid. This food for the year was divided as follows:



From the information above find the answers to these:

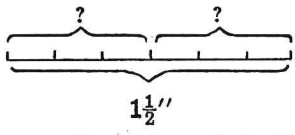
1. How much more than the hen weighed did the eggs she laid weigh?
2. How much did the food weigh that the hen ate?
3. How many pounds of food listed did the hen eat on the average a week? Count 52 weeks as a year.
4. How much more was received for a dozen eggs than the food cost for each dozen eggs laid?
5. How many dozen eggs did the hen lay in all?
6. How much was received in all for the eggs the hen laid?

*7. How much did the food for the whole year cost?

*8. How much more was received for all the eggs the hen laid than was paid out for the food that she ate?

*9. Why do the prices of eggs change during the year? Do all eggs sell at the same price at any one time?

MULTIPLYING MIXED NUMBERS AND FRACTIONS



1. The line at the left is $1\frac{1}{2}$ inches long. How many half inches are there in the line? How many quarter inches?

2. How long is half of the line? $\frac{1}{2}$ of $1\frac{1}{2}$ inches = ?

3. You know that $\frac{1}{2}$ of $1\frac{1}{2}$ is the same as $\frac{1}{2} \times 1\frac{1}{2}$ inches. To find $\frac{1}{2} \times 1\frac{1}{2}$ inches by multiplication, you can do the work as shown below.

$\frac{1}{2} \times 1\frac{1}{2} =$

$\frac{1}{2} \times \frac{3}{2} = \frac{1 \times 3}{2 \times 2} = \frac{3}{4}$

Before you multiply $\frac{1}{2} \times 1\frac{1}{2}$, change $1\frac{1}{2}$ to $\frac{3}{2}$. Then multiply as in multiplying two fractions. The answer is $\frac{3}{4}$, the same as in 2 above.

4. Study the work below carefully. Then copy the examples and work them.

a. $\frac{1}{2} \times 1\frac{1}{8} =$

$\frac{1}{2} \times \frac{9}{8} = \frac{1 \times 9}{2 \times 8} = \frac{9}{16}$

b. $1\frac{1}{3} \times \frac{1}{4} =$

$\frac{4}{3} \times \frac{1}{4} = \frac{4 \times 1}{3 \times 4} = \frac{4}{12} = \frac{1}{3}$

5. How much is $\frac{3}{4}$ of a board $1\frac{1}{3}$ feet long?
THINK: $\frac{3}{4} \times \frac{4}{3} = ?$

6. How much is $\frac{1}{2}$ of $1\frac{3}{4}$ yards of cloth?
THINK: $1\frac{3}{4} = \frac{4}{4} + \frac{3}{4} = \frac{7}{4}$
$\frac{1}{2}$ of $1\frac{3}{4} = \frac{1}{2} \times \frac{7}{4} = ?$

To multiply a mixed number by a fraction, change the mixed number to an improper fraction and then multiply as in multiplying two fractions.

7. Change to improper fractions: $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{2}{3}$, $1\frac{3}{8}$, $1\frac{7}{8}$.

Multiply:

	a	*b*	*c*	*d*	*e*
8.	$\frac{1}{2} \times 1\frac{1}{4} =$	$\frac{2}{3} \times 1\frac{2}{3} =$	$\frac{3}{4} \times 1\frac{5}{8} =$	$\frac{1}{3} \times 1\frac{7}{8} =$	$\frac{3}{4} \times 1\frac{1}{3} =$
9.	$1\frac{3}{8} \times \frac{3}{4} =$	$\frac{2}{3} \times 1\frac{1}{2} =$	$1\frac{1}{2} \times \frac{1}{2} =$	$1\frac{1}{4} \times \frac{2}{5} =$	$1\frac{1}{4} \times \frac{3}{4} =$

REDUCING MIXED NUMBERS TO IMPROPER FRACTIONS

1. Jack cut in half a piece of wood $3\frac{1}{2}$ inches long. How long was each piece?

THINK: $\frac{1}{2}$ of $3\frac{1}{2}$ in. $= \frac{1}{2} \times 3\frac{1}{2}$ in. $= ?$

First you must change $3\frac{1}{2}$ to a fraction before you can multiply. Change $3\frac{1}{2}$ to halves.

2. How many half inches are there in 1 inch? Use your ruler to find out.

3. How many half inches are there in $3\frac{1}{2}$ inches?

You can see that $3\frac{1}{2}$ in. $= \frac{6}{2}$ in. $+ \frac{1}{2}$ in., or $\frac{7}{2}$ in.

4. You can see that $\frac{1}{2} \times 3\frac{1}{2}$ is the same as $\frac{1}{2} \times \frac{7}{2}$.

$\frac{1}{2} \times 3\frac{1}{2} = \frac{1}{2} \times \frac{7}{2} = \frac{1 \times 7}{2 \times 2} = \frac{7}{4} = 1\frac{3}{4}$

Each piece in problem 1 was $1\frac{3}{4}$ inches long. Prove by addition that this result is correct. Prove it with a ruler.

5. How many half oranges are there in $4\frac{1}{2}$ oranges?

THINK: $4 = 4 \times \frac{2}{2} = \frac{8}{2}$.

So $4\frac{1}{2} = \frac{8}{2} + \frac{1}{2} = \frac{9}{2}$.

6. How many halves are there in $6\frac{1}{2}$? in $7\frac{1}{2}$? in $9\frac{1}{2}$?

7. How many thirds are there in $3\frac{1}{3}$?

THINK: $3 = 3 \times \frac{3}{3}$, or $\frac{9}{3}$; so $3\frac{1}{3} = \frac{9}{3} + \frac{1}{3} = \frac{10}{3}$.

8. $4\frac{1}{4} = 4 \times \frac{4}{4} + \frac{1}{4} = \frac{?}{4}$

9. $7\frac{3}{4} = 7 \times \frac{4}{4} + \frac{3}{4} = \frac{?}{4}$

10. $3\frac{2}{3} = 3 \times \frac{?}{3} + \frac{2}{3} = \frac{?}{3}$

11. $5\frac{3}{8} = 5 \times \frac{?}{8} + \frac{3}{8} = \frac{?}{8}$

To change a mixed number to an improper fraction, multiply the whole number by the denominator of the fraction, and to the product add the numerator of the fraction. Write the sum over the denominator.

Thus, $5\frac{1}{4} = \frac{20 + 1}{4} = \frac{21}{4}$.

Reduce to improper fractions:

12. $5\frac{1}{2} = \frac{?}{2}$

13. $2\frac{2}{3} = \frac{?}{3}$

14. $4\frac{1}{4} = \frac{?}{4}$

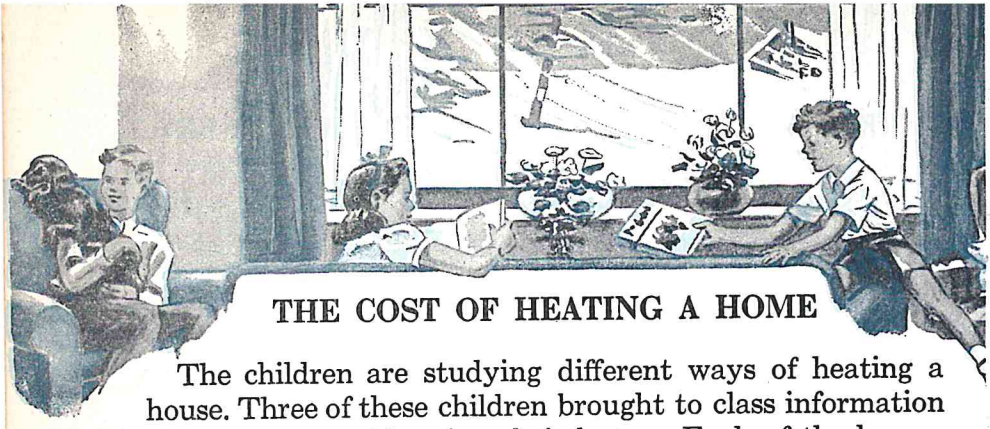
15. $3\frac{2}{5} = \frac{?}{5}$

16. $6\frac{3}{4} = \frac{?}{4}$

17. $7\frac{5}{8} = \frac{?}{8}$

18. $9\frac{5}{6} = \frac{?}{6}$

19. $4\frac{3}{8} = \frac{?}{8}$



THE COST OF HEATING A HOME

The children are studying different ways of heating a house. Three of these children brought to class information about the cost of heating their homes. Each of the houses had six rooms.

1. In Tom's home $7\frac{1}{2}$ tons of hard coal costing \$13.60 a ton were needed during the year. How much did the coal cost?

2. In Martha's home 900 gallons of furnace oil were needed at $7\frac{1}{2}$ cents a gallon. How much did the oil cost?

3. Gas was used to heat Sally's home. The total cost for the year was \$95.70. Was this cost more or less than the cost of heating the other houses with coal or with oil? How much?

*4. Some of the children thought that the results of these problems showed that it was cheapest to heat a six-room home with oil. Do you think that they were right? Why?

*5. What is the cheapest way of heating homes where you live? Discuss reasons why.

PRACTICE IN REDUCING MIXED NUMBERS

1 Change $2\frac{3}{4}$ to an improper fraction. Show with a ruler that $2\frac{3}{4}$ inches equals $\frac{11}{4}$ inches.

Change the following to improper fractions:

2. $2\frac{1}{2}$, $3\frac{1}{4}$, $4\frac{3}{4}$
3. $3\frac{1}{8}$, $5\frac{2}{5}$, $6\frac{7}{8}$
4. $7\frac{3}{8}$, $4\frac{2}{3}$, $8\frac{1}{2}$
5. $6\frac{2}{3}$, $7\frac{3}{4}$, $5\frac{5}{6}$
6. $7\frac{1}{10}$, $7\frac{1}{2}$, $9\frac{2}{3}$
7. $8\frac{17}{100}$, $4\frac{7}{10}$, $9\frac{1}{10}$
8. $6\frac{1}{4}$, $4\frac{2}{3}$, $5\frac{1}{2}$
9. $6\frac{7}{8}$, $7\frac{1}{10}$, $9\frac{1}{5}$
10. $2\frac{7}{24}$, $3\frac{17}{20}$, $9\frac{15}{16}$

MULTIPLYING MIXED NUMBERS AND FRACTIONS

1. If a farmer can raise $4\frac{3}{4}$ tons of hay on an acre of ground, how much hay can he raise on $\frac{1}{2}$ acre of ground?

THINK: $\frac{1}{2} \times 4\frac{3}{4}$ tons $= ?$

$\frac{1}{2} \times 4\frac{3}{4} =$

$\frac{1}{2} \times \frac{19}{4} = \frac{19}{8} = 2\frac{3}{8}$

Change $4\frac{3}{4}$ to fourths. Then multiply as in multiplying two fractions. He can raise $2\frac{3}{8}$ tons on $\frac{1}{2}$ acre.

2. Study the work below carefully. Copy the examples, and work them with your book closed.

a. $\frac{1}{4} \times 2\frac{2}{3} =$

$\frac{1}{4} \times \frac{8}{3} = \frac{1 \times 8}{4 \times 3} = \frac{8}{12} = \frac{2}{3}$

b. $7\frac{1}{2} \times \frac{2}{3} =$

$\frac{15}{2} \times \frac{2}{3} = \frac{15 \times 2}{2 \times 3} = \frac{30}{6} = 5$

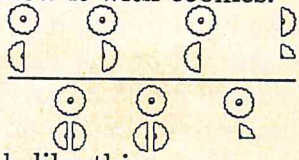
3. Work examples *a* and *b*. Divide before you multiply.

4. How much is $1\frac{1}{2} \times 3\frac{1}{2}$? Let's show it with cookies.

$3\frac{1}{2}$ cookies or $1 \times 3\frac{1}{2} =$

$\frac{1}{2}$ of $3\frac{1}{2}$ cookies, $\frac{1}{2} \times 3\frac{1}{2} =$

Put them together, $1\frac{1}{2} \times 3\frac{1}{2} =$



(The four halves make 2 cookies)

We work the example, $1\frac{1}{2} \times 3\frac{1}{2}$, like this:

$1\frac{1}{2} \times 3\frac{1}{2} =$

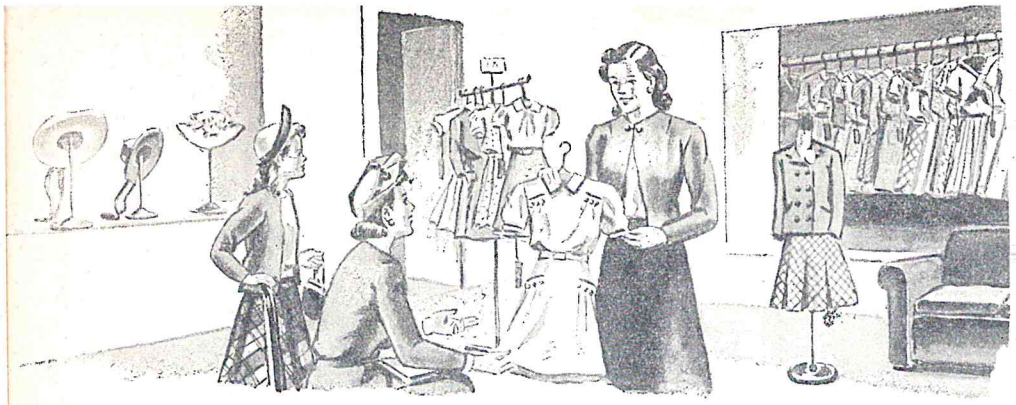
$\frac{3}{2} \times \frac{7}{2} = \frac{3 \times 7}{2 \times 2} = \frac{21}{4} = 5\frac{1}{4}$

Change $1\frac{1}{2}$ and $3\frac{1}{2}$ to improper fractions. Then multiply as in multiplying two fractions. How do we get the $\frac{21}{4}$? the $5\frac{1}{4}$?

Multiply:

	a	*b*	*c*	*d*
5.	$\frac{1}{4} \times 3\frac{3}{5} =$	$\frac{1}{2} \times 3\frac{1}{3} =$	$\frac{2}{3} \times 6\frac{2}{3} =$	$\frac{4}{5} \times 1\frac{1}{4} =$
6.	$3\frac{1}{2} \times \frac{3}{4} =$	$4\frac{2}{5} \times \frac{5}{8} =$	$4\frac{1}{2} \times \frac{5}{6} =$	$2\frac{1}{2} \times \frac{2}{5} =$
7.	$2\frac{1}{2} \times 1\frac{1}{4} =$	$4\frac{1}{4} \times 6\frac{2}{3} =$	$6\frac{1}{2} \times 2\frac{2}{3} =$	$5\frac{1}{4} \times 4\frac{5}{6} =$
8.	$7\frac{1}{3} \times 2\frac{2}{5} =$	$3\frac{1}{3} \times 3\frac{3}{5} =$	$1\frac{1}{8} \times 1\frac{1}{3} =$	$1\frac{1}{4} \times 2\frac{2}{5} =$
9.	$\frac{1}{3} \times 1\frac{4}{5} =$	$5\frac{5}{6} \times \frac{2}{3} =$	$9\frac{1}{3} \times 2\frac{3}{4} =$	$2\frac{1}{4} \times 4\frac{1}{2} =$

10. Work the above examples again, dividing before you multiply when possible.



A NEW DRESS—SHOULD SHE MAKE IT OR BUY IT?

At the store Joan's mother saw a dress marked \$4.70. She estimated that $3\frac{1}{2}$ yards of cloth were needed for the dress. A clerk showed her cloth very much like the cloth in the dress which was sold for 70 cents a yard.

If she made the dress, Joan's mother knew that she would also have to buy bias tape for 10 cents, thread for 10 cents, 6 buttons at 5 cents each, a belt buckle for 25 cents, and a pattern for 35 cents. She thought it would take her about 7 hours to make the dress.

1. How much would the cloth cost?
2. What would be the total cost of the cloth and the other things Joan's mother would have to buy to make the dress?
3. How much less would be the cost of making the dress than the price of the dress at the store?
4. If Joan's mother worked 7 hours to save \$1.15, how much would she save in an hour?
5. A dressmaker would charge Joan's mother 40 cents an hour for her time, which would be about $6\frac{1}{2}$ hours. If Joan's mother had the dressmaker make the dress, how much would she have to pay the dressmaker?

*6. Which of these do you think Joan's mother should do, buy the dress at the store, make the dress herself, or have a dressmaker make it? Give the reasons for your answer.

WE OFTEN USE FRACTIONS AND DECIMALS

These problems show everyday uses of fractions and decimals.

1. Jane's mother has an electric flatiron. In the city where she lives it costs $3\frac{3}{4}$ cents an hour to use the iron. One week she used the iron $2\frac{2}{3}$ hours. How much did the electricity cost?

2. In 1920 the farmer received 13.4 cents a pound for hogs. In a more recent year he received 7.6 cents a pound. How much was the difference?

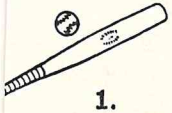
3. The average temperature for April where Jane lives is 59.4°. One day the temperature at noon was 68.2°. How much higher than the monthly average was this?

4. Find the total cost of two chickens at 32 cents a pound if one chicken weighed $3\frac{1}{2}$ pounds and the other $3\frac{3}{4}$ pounds.

5. Jane saw handkerchiefs on sale at 2 for 25 cents. How much would 6 handkerchiefs cost?

6. How many hours and minutes is it from 9:45 A.M. to 2:30 P.M.?

LET'S PRACTICE



	a	*b*	*c*	*d*	*e*
1.	$2\frac{3}{4}$ $+7\frac{3}{4}$	427 $\times 98$	$4 \times \frac{1}{3} =$	$8\frac{1}{4}$ $-5\frac{3}{4}$	78.6 -25.9
2.	$6 \times \frac{3}{4} =$	7.96 -2.85	$8\frac{1}{2}$ $-6\frac{3}{4}$	$6\frac{2}{3}$ $-4\frac{1}{2}$	$\frac{1}{2} \times 9 =$
3.	4.76 -3.94	$7\frac{2}{3}$ $+9\frac{5}{6}$	$53\overline{)35510}$	$7\frac{1}{2}$ $\times 8$	978 $\times 200$
4.	639 $\times 705$	$18\overline{)1494}$	$2\frac{1}{2} \times 3\frac{1}{3} =$	$4\frac{5}{6}$ $+6\frac{3}{4}$	$37\overline{)30586}$

TWO WAYS OF MULTIPLYING WHOLE NUMBERS AND FRACTIONS

1. How much do $3\frac{3}{4}$ pounds of butter cost at 40 cents a pound?

THINK: $3\frac{3}{4} \times \$.40 = ?$

There are two ways of working this example:

A.

$$\begin{array}{r} \$\ .40 \\ \times 3\frac{3}{4} \\ \hline 30 \quad (\frac{3}{4} \times 40) \\ 120 \quad (3 \times 40) \\ \hline \$1.50 \end{array}$$

B. $3\frac{3}{4} \times 40 =$

$\frac{15}{\cancel{4}_{1}} \times \cancel{40}^{10} = \frac{15 \times 10}{1} = \frac{150}{1} = 150$ cents, or $1.50

How does the work in B differ from the work in A?

2. Use both methods to find the cost of $4\frac{3}{4}$ pounds of coffee at 28 cents a pound. Which method is easier?

3. In working the example $3\frac{1}{2} \times 8$, would you use method A or method B? Tell why.

4. In working the example $14 \times 5\frac{3}{4}$, which method do you think would be easier, A or B? Try them to find out.

Find these products. Use the method that you think is easier for each example:

	a	*b*	*c*	*d*
5.	$3\frac{1}{2} \times 4 =$	$5\frac{2}{3} \times 6 =$	$6\frac{3}{4} \times 15 =$	$27\frac{5}{8} \times 16 =$
6.	$3\frac{5}{8} \times 9 =$	$4\frac{1}{4} \times 7 =$	$8\frac{1}{2} \times 27 =$	$2\frac{2}{5} \times 10 =$
7.	$6\frac{1}{2} \times 8 =$	$4\frac{3}{4} \times 20 =$	$9\frac{2}{3} \times 47 =$	$6\frac{4}{5} \times 32 =$
8.	$8\frac{1}{4} \times 32 =$	$6\frac{3}{8} \times 96 =$	$4\frac{2}{5} \times 50 =$	$8\frac{5}{6} \times 90 =$

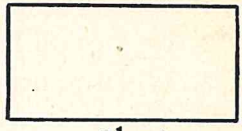
MIXED PRACTICE IN MULTIPLYING FRACTIONS

1.	$4 \times \frac{1}{2} =$	$\frac{3}{4} \times 7 =$	$4 \times 2\frac{1}{2} =$	$7 \times 5\frac{5}{6} =$
2.	$\frac{1}{2} \times \frac{1}{4} =$	$\frac{3}{4} \times 2\frac{1}{2} =$	$\frac{3}{4} \times \frac{7}{8} =$	$\frac{5}{6} \times 3\frac{1}{3} =$
3.	$2\frac{1}{2} \times 3\frac{1}{4} =$	$\frac{4}{5} \times \frac{5}{6} =$	$3\frac{1}{3} \times 9 =$	$5\frac{3}{5} \times 23 =$
4.	$\begin{array}{r} 28 \\ \times 5\frac{1}{2} \\ \hline \end{array}$	$\begin{array}{r} 38\frac{3}{4} \\ \times 20 \\ \hline \end{array}$	$\begin{array}{r} 85 \\ \times 4\frac{5}{6} \\ \hline \end{array}$	$\begin{array}{r} 36\frac{1}{2} \\ \times 18 \\ \hline \end{array}$

ON A WHEAT FARM

Ole lives on a big wheat farm. Here are some problems he gave the class about his farm:

1. This drawing shows the dimensions of our farm. How much longer is the farm than it is wide?



2. What is the perimeter of our farm?

3. Find the area of our farm in square miles.

4. How many acres are there in our farm?

5. We have 1500 acres planted to wheat. We raise on the average $15\frac{1}{2}$ bushels to the acre. How many bushels do we raise on our farm?

6. On one very fine field of 20 acres we raised 415 bushels. How much more than the average did this field produce an acre?

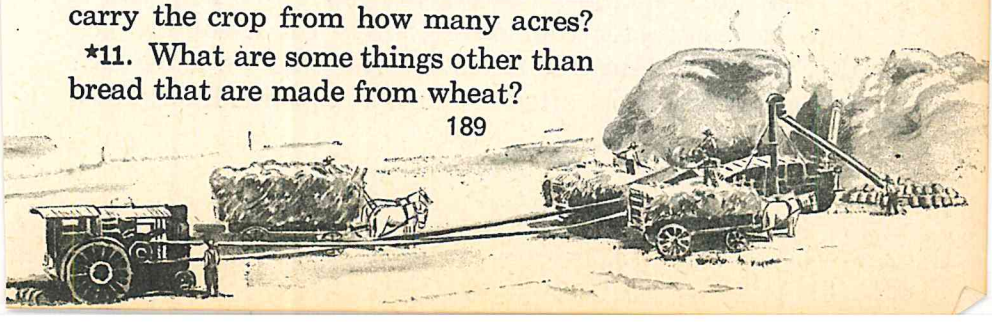
7. We sold the wheat last year for $\$.85\frac{1}{2}$ bushel. Several years ago we received $\$1.08\frac{3}{8}$ a bushel. How much more did we receive that year than last year?

8. In some countries the children of poor people used to gather the seeds that fell to the ground. About 12,000 seeds make a pound of unground wheat. About how many seeds are there in one bushel of wheat (60 lb.)?

9. A pound of unground wheat makes $\frac{5}{8}$ pound of flour. At this rate how many pounds of flour does one bushel of wheat make?

10. Some steamers can carry 300,000 bushels of wheat at one time. If we count 15 bushels as the crop of one acre, one of these steamers when loaded can carry the crop from how many acres?

*11. What are some things other than bread that are made from wheat?



THINGS TO REMEMBER ABOUT MULTIPLYING FRACTIONS

1. Always go over your work to find any careless errors.
2. Reduce all fractions in answers to lowest terms.
3. When multiplying two mixed numbers, or a fraction and a mixed number, change the mixed numbers to improper fractions.
4. In multiplying any kind of fractions, be sure to multiply the numerators and then to multiply the denominators.
5. Use division before you multiply whenever you think it will save time. Be sure to divide only one numerator and only one denominator by the same number.
6. Watch the 1's in dividing and multiplying. To be correct write the 1's after you have divided, or cancelled.
7. Be sure that all of your computations are correct.

PRACTICE IN MULTIPLYING FRACTIONS

Find the products of the examples below. When you have completed the set of examples, try to find the reasons for any errors you made.

	a	*b*	*c*	*d*
1.	$\frac{1}{6} \times 4 =$	$2\frac{1}{2} \times 2\frac{2}{5} =$	$\frac{3}{4} \times \frac{4}{5} =$	$4\frac{1}{4} \times \frac{4}{5} =$
2.	$\frac{1}{4} \times \frac{3}{4} =$	$14 \times \frac{3}{4} =$	$\frac{1}{2} \times 2\frac{2}{3} =$	$15 \times 7\frac{3}{8} =$
3.	$\frac{1}{3} \times 7 =$	$\frac{9}{10} \times \frac{2}{3} =$	$8 \times 9\frac{3}{4} =$	$5\frac{1}{3} \times 3\frac{3}{4} =$
4.	$7 \times 5\frac{5}{6} =$	$4\frac{2}{3} \times 8 =$	$1\frac{1}{3} \times \frac{3}{4} =$	$6 \times 27\frac{1}{2} =$

What are the kinds of errors you made? To help you to find the reasons for your errors, study the lesson on page 191, which contains the kinds of errors that we know boys and girls make most often in multiplying with fractions.

FINDING ERRORS IN MULTIPLICATION OF FRACTIONS

The examples below contain the kinds of errors that we know boys and girls make most frequently in multiplication of fractions. Study each example carefully to find the kinds of errors it contains. Then work the example correctly. Make a list of all the kinds of errors you find. Do you ever make such errors?

1. $\frac{3}{5} \times 27 = \frac{71}{5} = 14\frac{1}{5}$
2. $4 \times \frac{7}{8} = \frac{28}{8}$
3. $\frac{1}{3} \times \frac{7}{8} = \frac{8}{24}$
4. $\frac{\overset{1}{\cancel{5}}}{\underset{3}{\cancel{8}}} \times \frac{\overset{1}{\cancel{4}}}{\underset{3}{\cancel{15}}} = \frac{2}{6} = \frac{1}{3}$
5. $\frac{4}{5} \times \frac{10}{12} = \frac{5}{3} = 1\frac{2}{3}$
6. $\frac{1}{4} \times 8 = \frac{33}{4} = 8\frac{1}{4}$
7. $3\frac{1}{3} \times 3\frac{3}{4} =$

   $\frac{\overset{5}{\cancel{10}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{5}{\cancel{15}}}{\underset{2}{\cancel{4}}} = 25$
8. $\frac{3}{5} \times 5\frac{1}{4} =$

   $\frac{\cancel{5}}{\cancel{3}} \times \frac{\overset{7}{\cancel{21}}}{4} = \frac{35}{4} = 8\frac{1}{2}$

PRACTICE IN FINDING REASONS FOR ERRORS

The examples given below are the twelve most difficult examples found in a test given to a large number of sixth-grade children. How many of them can you work correctly? After your work is completed, go over the examples that were incorrect and try to find the reasons for your errors. Try not to repeat the same kind of error in the future.

	a	*b*	*c*	*d*
1.	$3\frac{1}{3} \times \frac{1}{8} =$	$6 \times 3\frac{3}{4} =$	$3\frac{1}{6} \times 4 =$	$2\frac{1}{2} \times 2\frac{1}{4} =$
2.	$2\frac{1}{4} \times \frac{1}{4} =$	$6\frac{4}{5} \times \frac{3}{7} =$	$3\frac{3}{4} \times 3\frac{1}{3} =$	$3\frac{2}{7} \times 3\frac{2}{3} =$
3.	$36\frac{5}{6}$ $\times 12$	18 $\times 15\frac{3}{4}$	25 $\times 27\frac{1}{2}$	23 $\times 18\frac{3}{5}$

*CHANGING MAGIC SQUARES

1. Show by adding the numbers by rows, columns, and diagonals that the square at the right is a magic square. The sums should be the same in all directions.

2	$\frac{3}{8}$	$\frac{1}{4}$	$1\frac{5}{8}$
$\frac{5}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	1
$1\frac{1}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$1\frac{1}{2}$
$\frac{1}{2}$	$1\frac{7}{8}$	$1\frac{3}{4}$	$\frac{1}{8}$

2. On your paper draw a square like the one at the right containing sixteen blocks, or cells. Now multiply each number in the magic square by 2 and write the product in the same cell. Then add the numbers in your square to see if it is still a magic square.

3. Repeat the experiment in problem 2 with the squares below. See if they are still magic squares after multiplying the numbers by 3, 4, or 6.

$2\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	$2\frac{1}{6}$
$\frac{5}{6}$	$1\frac{2}{3}$	$1\frac{5}{6}$	$1\frac{1}{3}$
$1\frac{1}{2}$	1	$1\frac{1}{6}$	2
$\frac{2}{3}$	$2\frac{1}{2}$	$2\frac{1}{3}$	$\frac{1}{6}$

$5\frac{1}{3}$	1	$\frac{2}{3}$	$4\frac{1}{3}$
$1\frac{2}{3}$	$3\frac{1}{3}$	$3\frac{2}{3}$	$2\frac{2}{3}$
3	2	$2\frac{1}{3}$	4
$1\frac{1}{3}$	5	$4\frac{2}{3}$	$\frac{1}{3}$

4. Does multiplying all of the numbers in a magic square by the same number change the square so that it is no longer a magic square?

5. Make a new square with one of the magic squares above by adding some number like $\frac{1}{2}$, $\frac{1}{4}$, 2, or 3 to each number in the square. Is the square then a magic square?

6. Subtract some fraction like $\frac{1}{8}$, $\frac{1}{4}$, or $\frac{1}{6}$ from each number in one of the magic squares above. Then find out if the square is still a magic square.

DIAGNOSTIC TEST IN MULTIPLICATION OF FRACTIONS

If you have more than two examples incorrect in any row, turn back to the page given at the right of the row for help. Do not be satisfied until you can work every example in the test correctly.

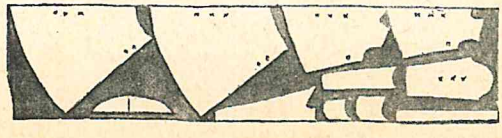
	a	*b*	*c*	*d*	
1.	$\frac{1}{3} \times \frac{1}{2} =$	$\frac{2}{3} \times \frac{3}{4} =$	$\frac{3}{8} \times \frac{5}{6} =$	$\frac{1}{2} \times \frac{4}{5} =$	(177)
2.	$\frac{1}{2} \times 1\frac{1}{4} =$	$\frac{1}{3} \times 3\frac{3}{4} =$	$\frac{2}{3} \times 5\frac{2}{5} =$	$\frac{2}{3} \times 7\frac{1}{2} =$	(182)
3.	$3\frac{1}{3} \times \frac{1}{4} =$	$2\frac{2}{3} \times \frac{1}{8} =$	$4\frac{1}{2} \times \frac{3}{4} =$	$17\frac{1}{2} \times \frac{4}{5} =$	(185)
4.	$3\frac{1}{2} \times 2\frac{1}{4} =$	$1\frac{1}{4} \times 2\frac{2}{5} =$	$3\frac{1}{3} \times 2\frac{5}{8} =$	$4\frac{1}{2} \times 3\frac{5}{6} =$	(185)
5.	$\begin{array}{r} 7 \\ \times 5\frac{3}{8} \\ \hline \end{array}$	$\begin{array}{r} 21 \\ \times 4\frac{3}{4} \\ \hline \end{array}$	$\begin{array}{r} 16\frac{2}{3} \\ \times 6 \\ \hline \end{array}$	$\begin{array}{r} 19\frac{7}{8} \\ \times 9 \\ \hline \end{array}$	(188)

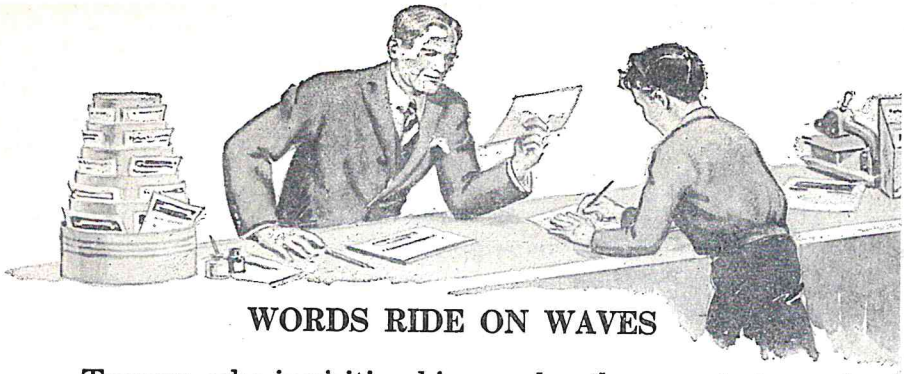
Repeat the diagnostic test on page 172.

*INTERESTING FACTS TO FIND OUT

If your work in the tests shows that you do not need more practice in multiplication of fractions, you may prepare a short report on one of the topics below, or some similar one approved by your teacher. Be sure that the information you give is correct, and be ready to tell where you found it.

1. How the size of gloves is measured.
2. What the numbers of a radio station mean.
3. Reductions at local stores.
4. Why not sell by the bushel?
5. The system of numbering houses in our city.
6. How patterns help the dressmaker.
7. Prices of fresh fruit in the summer and winter.
8. Extent of damage done to our trees by insects.





WORDS RIDE ON WAVES

Tommy, who is visiting his grandmother, wants to send a 20-word telegram to his mother on her birthday. Here are some interesting things he learned about the rates for sending telegrams.

1. He found that the full rate for sending a telegram for prompt delivery was 90 cents for the first 10 words and 6 cents for each additional word. How much would it cost to send his 20-word message?

2. If he sent a night message, the rate was 54 cents for the first 10 words and $2\frac{2}{5}$ cents for each additional word. How much would it cost to send his telegram as a night message?

3. If he sent his message as a night letter, the rate was 90 cents for the first 50 words. How much would it cost to send his message as a night letter?

4. Which of these three ways of sending his message was the cheapest?

5. Tommy also learned that one could cable messages to a city in China at 40 cents a word. How much would be the cost of sending a cable of 42 words?

6. He was told that one could radio to ships at certain places in the Atlantic at the rate of 23 cents a word. How much would it cost to radio a message of 20 words?

*7. Try to find out why the rates for all telegrams are not the same. Is there a tax on sending telegrams and cablegrams? How does the Navy send messages by blinker?

LET'S PRACTICE

Practice one of these sets of examples a day. If you need more practice, work the same set of examples on several days. Keep a record of your scores to see if your work improves.

Set I

1. $\begin{array}{r} \$859 \\ 246 \\ 6375 \\ 918 \\ 27157 \\ \underline{648} \end{array}$

2. $\begin{array}{r} 48276 \\ \underline{-29368} \end{array}$

3. $\begin{array}{r} 975 \\ \underline{\times 480} \end{array}$

4. $69\overline{)5418}$

5. $\begin{array}{r} 6\frac{1}{4} \\ 5\frac{1}{4} \\ \underline{4\frac{3}{4}} \end{array}$

6. $\begin{array}{r} 64 \\ \underline{-23\frac{1}{4}} \end{array}$

7. $\frac{3}{4} \times 12 =$

8. $6\frac{3}{4} + 7\frac{7}{8} =$

9. $16 \times \frac{7}{8} =$

10. $8\frac{1}{2} - 4 =$

11. $2\frac{1}{2} \times 1\frac{1}{5} =$

Set II

1. $\begin{array}{r} 252 \\ 926 \\ 9845 \\ 596 \\ 4663 \\ \underline{378} \end{array}$

2. $\begin{array}{r} 70045 \\ \underline{-68279} \end{array}$

3. $\begin{array}{r} 648 \\ \underline{\times 907} \end{array}$

4. $28\overline{)1652}$

5. $\begin{array}{r} 7\frac{1}{2} \\ 6\frac{1}{4} \\ \underline{4\frac{1}{4}} \end{array}$

6. $\begin{array}{r} 6\frac{7}{8} \\ \underline{-2\frac{1}{2}} \end{array}$

7. $\begin{array}{r} 25\frac{1}{2} \\ \underline{\times 6} \end{array}$

8. $\frac{1}{2} + \frac{1}{4} + \frac{3}{8} =$

9. $3\frac{1}{3} \times 2\frac{1}{2} =$

10. $7 - 6\frac{1}{5} =$

11. $\frac{1}{4} \times 3\frac{1}{3} =$

USING THE VOCABULARY OF ARITHMETIC

Make a list of the units used to measure each of the following. Arrange them in the order of their size. Write the smallest unit first.

length	money value	amount of liquid	weight
time	area	amount of vegetables	temperature

HOW WELL DO YOU REMEMBER?

1. How much is 3842 $\times$ 5400?
2. Show that a square is a rectangle.
3. Are all rectangles squares?
4. What must you know in order to find the area of a farm?
5. What is meant by "cancellation"? When can you use cancellation?
6. Give each step in working the example $2\frac{1}{2} \times 3\frac{1}{3}$.
7. Express the answer to the example $\frac{9}{10} \times \frac{3}{10}$ as a decimal.
8. State to the nearest million: 3,748,000; 6,195,208.
9. Give to the nearest inch: $3\frac{3}{4}$ in., $4\frac{3}{10}$ in., 5.6 in., 7.1 in.
10. How do you find what part of a yard 9 inches is?
11. How do you find $\frac{3}{4}$ of a number?
12. How much is 8 lb. 5 oz. $-$ 4 lb. 9 oz.?

INFORMATION PLEASE!

1. What measurements are used in cooking?
2. How is arithmetic used in music?
3. How does large-scale production of ice cream affect the price of ice cream?
4. What is meant by the "gasoline tax"? What is the money raised through this tax used for in your state?
5. What kinds of information can be shown by dot maps? Why is it often difficult to get exact information from a dot map?
6. How much does it cost to send a telegram?
7. How would you go about finding the difference in the cost of several ways of heating a home?
8. How much does it cost to use some of our electric servants?

MEASURING GROWTH IN PROBLEM SOLVING

1. Joe wants to buy a $28.50 bicycle. He has $19.75. How much more does he need?

2. How many pounds of meat does a family use in a year if it uses 35 pounds a month?

3. Ann bought 12 cans of peaches for $1.56. How much a can did the peaches cost?

4. How much does $\frac{3}{4}$ pound of butter cost at $.48 a pound?

5. If 20 pounds of sugar cost $1.15, what is the price a pound?

6. What is the distance around the four sides of a farm that is .75 mile long and .35 mile wide?

7. On four pages of a book Sally counted 368 words, 372 words, 380 words, and 376 words. How many words were there on the average on a page?

8. Mrs. Brown bought 3 bars of soap for 10 cents. How much would she have to pay for a dozen bars at this price?

9. Each day Arthur drinks $\frac{3}{4}$ quart of milk, Betty drinks $1\frac{1}{4}$ quarts of milk, and David drinks $\frac{1}{2}$ quart of milk. How much less than a gallon of milk do the three children drink in one day?

10. The electricity for Helen's lamp costs $\frac{3}{5}$ cent an hour. How much does it cost to use the lamp from 6:30 to 9:00 in the evening while Helen is studying her lessons?

What Your Score Means

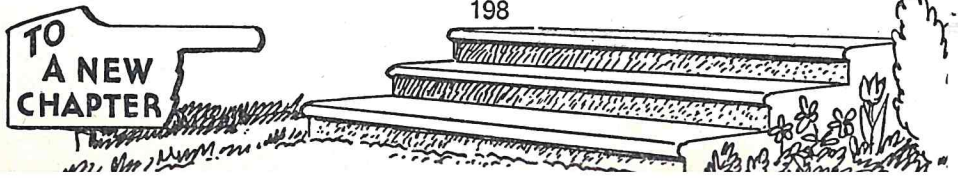
Unsatisfactory	Fair	Good	Excellent
0 1 2 3 4	5 6	7 8	9 10

UP THE STEPS TO A NEW CHAPTER

This test will help you to find out how well you understand the work you have had. When you copy the numbers, be sure to leave enough space for your work.

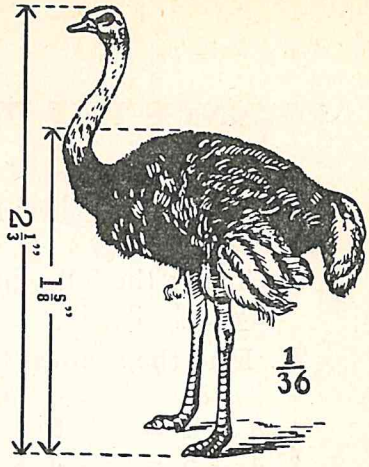
1. Add: 6 lb. 4 oz. + 9 lb. 8 oz. + 5 lb. 10 oz. = ? (156)
2. Multiply 846 by 957. (58)
3. How much is 400 × $37.50? (57)
4. Divide 82560 by 96. Check your answer. (76)
5. How much is 3132 divided by 36? (88)
6. Divide 7560 by 14. Check your answer. (96)
7. Express as decimals: $\frac{5}{10}$; $\frac{8}{100}$; $\frac{7}{1000}$. (38)
8. Add: 4.37 + 19.65 + 8.40 + .67 = ? (42)
9. Subtract 6.375 from 15.625. Check by addition. (49)
10. Supply the missing numerators: $\frac{3}{4} = \frac{?}{12}$; $\frac{7}{10} = \frac{?}{100}$; $\frac{5}{8} = \frac{?}{16}$; $\frac{2}{3} = \frac{?}{12}$. (116)
11. Express in simplest form: $8\frac{8}{8}$; $7\frac{6}{2}$; $9\frac{27}{8}$; $6\frac{5}{10}$. (23)
12. Find the sum of $7\frac{3}{4} + 4\frac{5}{6}$. (121)
13. Subtract $8\frac{1}{3}$ from $15\frac{1}{2}$. (140)
14. Add the numbers: $8\frac{1}{2} + 6\frac{3}{4} + 9\frac{7}{8}$ = ? (114)
15. Subtract $6\frac{3}{4}$ from $12\frac{5}{8}$. Check by addition. (144)
16. How much is $8 \times \frac{5}{6}$? (165)
17. Reduce to improper fractions: $1\frac{1}{4}$; $2\frac{3}{5}$; $8\frac{1}{2}$. (183)
18. Multiply $\frac{3}{4} \times 3\frac{1}{5}$. (185)
19. Find the product of $4\frac{1}{2} \times 6\frac{2}{3}$. (185)
20. How much do 8 pounds of lard cost at $12\frac{1}{2}$ cents a pound? (188)

After your paper has been marked, correct your errors at once. If necessary, turn for help to the pages given at the right of the test. Be sure that you know how to work every example in the test before you go on to the next chapter.



CHAPTER VII

ANIMALS AND FISH ARE DRAWN TO SCALE

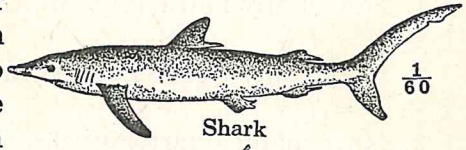


In dictionaries and other reference books animals are pictured to help the reader get an idea of their size and appearance. Notice the fraction $\frac{1}{36}$ beside the picture of the ostrich at the right. This means that the picture is $\frac{1}{36}$ actual life size, or that the ostrich is 36 times as tall as the picture shows.

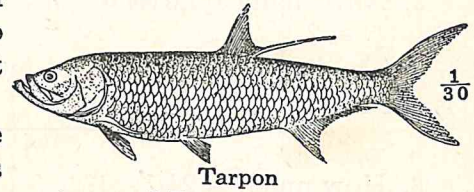
1. How tall are you? If you stood beside this ostrich, would the top of your head reach to the back of this ostrich?

2. How many feet is it from the top of this ostrich's head to the ground? Can you reach that high?

3. Measure with your ruler the distance from the tip of the mouth to the tip of the tail of the shark and the tarpon pictured at the right. Do they both measure about the same?



Shark

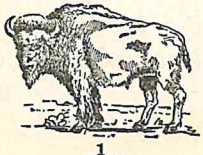


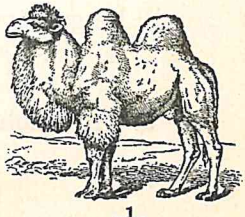
Tarpon

4. Is a shark the same length, about twice as long, or 4 times as long as a tarpon? Prove your answer.

5. Notice that the buffalo and the camel are both drawn to the same scale. What scale is it?

*6. About how many feet higher from the ground is the top of the camel's hump than the buffalo's back?





READINESS TEST FOR DIVISION OF FRACTIONS

I. Reduction of fractions.

1. Reduce the following to simplest form:

$\frac{3}{3}$ $\frac{5}{1}$ $\frac{8}{12}$ $\frac{15}{40}$ $\frac{18}{12}$ $7\frac{8}{10}$ $\frac{48}{15}$

2. Change the following to improper fractions:

$2\frac{1}{2}$ $6\frac{2}{3}$ $3\frac{3}{4}$ $5\frac{4}{5}$

II. Find the answers to the following:

	a	*b*	*c*	*d*
1.	$8 \div 4 =$	$8 \times \frac{1}{4} =$	$\frac{1}{4}$ of $8 =$	$\frac{1}{4} \times 8 =$
2.	$4 \div 5 =$	$4 \times \frac{1}{5} =$	$\frac{1}{5}$ of $4 =$	$\frac{1}{5} \times 4 =$

III. Multiply the following:

	a	*b*	*c*	*d*
1.	$6 \times \frac{3}{2} =$	$1 \times \frac{5}{3} =$	$\frac{2}{3} \times \frac{4}{1} =$	$\frac{11}{5} \times \frac{3}{1} =$
2.	$\frac{3}{4} \times \frac{2}{3} =$	$\frac{4}{5} \times \frac{1}{3} =$	$\frac{9}{8} \times \frac{12}{15} =$	$\frac{9}{4} \times \frac{6}{5} =$

IV. Give the answers to the following:

1. How many half circles are there in a whole circle?
$1 \div \frac{1}{2} = ?$

2. How many quarter circles are there in a whole circle?
$1 \div \frac{1}{4} = ?$

3. How many quarter circles are there in a half circle?
$\frac{1}{2} \div \frac{1}{4} = ?$

4. The line below is divided into $\frac{3}{4}$-inch parts. How long is the line?

5. How much is $2\frac{1}{4} \div \frac{3}{4}$?

V. Comparing numbers:

1. Tell in which of the following examples the quotient will be greater than 1. Do not work the examples.

a. $6 \div 4 =$	*c.* $\frac{1}{2} \div \frac{1}{4} =$	*e.* $\frac{1}{8} \div \frac{1}{2} =$	*g.* $6 \div 7\frac{2}{3} =$
b. $3 \div 5 =$	*d.* $3\frac{1}{2} \div 2\frac{1}{4} =$	*f.* $2\frac{1}{8} \div 3 =$	*h.* $5 \div \frac{3}{8} =$

2. In which examples will the quotient be less than 1?

USING FRACTIONS TO COMPARE NUMBERS

Sometimes we compare numbers with fractions without making exact comparisons.

1. What do we mean when we say, "About half of the people," or "about $\frac{3}{4}$ mile from here"? Are these exact amounts?

2. Is \$5.15 about $\frac{1}{2}$ or $\frac{1}{4}$ of \$10?

3. What are the correct answers to the five problems below?

a. \$2.85 is about $\frac{1}{2}$, $\frac{1}{4}$, or $\frac{1}{6}$ of \$6.
b. \$3.10 is about $\frac{1}{3}$, $\frac{1}{4}$, or $\frac{1}{5}$ of \$12.
c. 30 is about $\frac{1}{3}$, $\frac{1}{4}$, or $\frac{1}{5}$ of 89.
d. 59 is about $\frac{1}{2}$, $\frac{1}{4}$, or $\frac{1}{6}$ of 362.
e. 49 is about $\frac{1}{2}$, $\frac{3}{5}$, or $\frac{7}{8}$ of 78.

Fractions can also be used to compare larger numbers.

4. Is 995 about $\frac{1}{2}$ or $\frac{1}{3}$ of 1978?

THINK: $\frac{995}{1978}$ is about $\frac{1000}{2000}$, or $\frac{1}{2}$, when reduced to lowest terms.

5. 1490 is what part of 3020?

THINK: 1490 is about 1500, and 3020 is about 3000. 1500 is $\frac{1}{2}$ of 3000. So 1490 is about half of 3020.

6. Compare with a small or simple fraction 2945 and 9000.

7. Compare 2403 and 4815.

8. Is 1190 about $\frac{1}{3}$, $\frac{1}{4}$, or $\frac{1}{5}$ of 4800?

9. Use a simple fraction to compare 12150 and 35980.

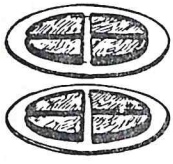
10. Use simple fractions to compare \$1.25 and \$5.98; \$1.50 and \$3.10; \$2950 and \$12175.

11. At a sale a \$15.00 table was sold for \$11.95. What was the reduction? Express the reduction as a fraction of \$15.00, using a simple fraction to make the comparison.

DIVIDING A WHOLE NUMBER BY A FRACTION

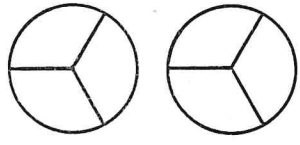
1. For the dinner party, Mary's father cut two steaks of equal size into fourths. How many pieces did he cut?

THINK: How many fourths are there in 2 steaks? $2 \div \frac{1}{4} = ?$



There are 4 fourths in one steak.
So there are 2×4, or 8 pieces in the two steaks.
You can see that the answer to the example $2 \div \frac{1}{4}$ is the same as the answer to the example 2×4.

2. Use the circles at the right to find how many thirds there are in two circles. How much is $2 \div \frac{1}{3}$?



3. Does $2 \div \frac{1}{3}$ equal 2×3?

4. Does 2×3 equal $2 \times \frac{3}{1}$? Find out by multiplying.

THINK: $2 \times \frac{3}{1} = \frac{6}{1} = 6$. This is equal to 2×3, or 6.

The work in problems 2 and 4 shows that the answers to the examples $2 \div \frac{1}{3}$, and $2 \times \frac{3}{1}$ are the same.

5. In problem 1 you found that $2 \div \frac{1}{4}$ was the same as 2×4. Show that the answers to $2 \div \frac{1}{4}$ and $2 \times \frac{4}{1}$ are the same. This shows that $2 \div \frac{1}{4} = 2 \times \frac{4}{1}$.

6. In what ways are the examples $2 \div \frac{1}{4}$ and $2 \times \frac{4}{1}$ different? You know that they have the same answer.

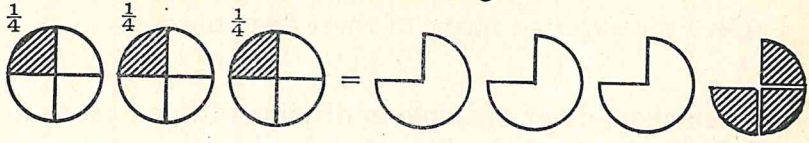
You can see that the division example $2 \div \frac{1}{4}$ can be changed to a multiplication example by changing the $\div$ sign to the $\times$ sign and changing about the terms of $\frac{1}{4}$ so that it becomes $\frac{4}{1}$.

7. How do you change the example $2 \div \frac{1}{3}$ to $2 \times \frac{3}{1}$?

8. How much is $3 \div \frac{1}{4}$? Use circles to find out. Does the example $3 \div \frac{1}{4}$ have the same answer as the example $3 \times \frac{4}{1}$?

DIVIDING BY OTHER FRACTIONS

The circles below will show you how to find the answer to the example $3 \div \frac{3}{4}$ from drawings.

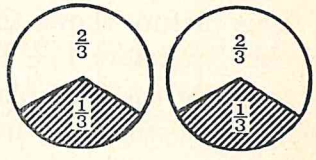


1. You can see that in each circle there is one $\frac{3}{4}$ circle, and one $\frac{1}{4}$ circle left over. In the three circles there are three $\frac{3}{4}$ circles and three $\frac{1}{4}$ circles. But three $\frac{1}{4}$ circles is the same as one $\frac{3}{4}$ circle. So there are how many $\frac{3}{4}$'s in the three circles? $3 \div \frac{3}{4}$ equals what?

2. Find the answer to the example $3 \times \frac{4}{3}$. How does your answer compare with the answer to problem 1?

You can see that the answers to the two examples $3 \div \frac{3}{4}$ and $3 \times \frac{4}{3}$ are the same. You can see that in the two examples the numbers are the same, but that to get $3 \times \frac{4}{3}$ we change the $\div$ sign to the $\times$ sign. Then we change about the terms in the $\frac{3}{4}$ by which we are dividing so that the fraction becomes $\frac{4}{3}$.

3. Use the circles at the right to find the answer to the example $2 \div \frac{2}{3} = ?$



4. Find the answer to the example $2 \times \frac{3}{2}$. How does your answer compare with the answer you found in problem 3?

5. Explain how to change $2 \div \frac{2}{3}$ to $2 \times \frac{3}{2}$.

6. Try to work the example $4 \div \frac{4}{5}$ by changing it into a multiplication example. Then check your answer by using circles as was done in problems 1 and 3 above.

DIVIDING BY INVERTING THE DIVISOR

When we change $\frac{1}{2}$ to $\frac{2}{1}$, or $\frac{3}{4}$ to $\frac{4}{3}$ we say that we **invert** the terms of the fraction, that is, we change them about.

1. Give the inverted forms of these fractions:

$\frac{1}{3}$ $\frac{1}{8}$ $\frac{1}{5}$ $\frac{2}{3}$ $\frac{3}{5}$ $\frac{4}{3}$ $\frac{3}{4}$ $\frac{1}{2}$ $\frac{5}{6}$

We can change any example in division of fractions to a multiplication example by inverting the divisor.

2. Study the following steps in dividing 4 by $\frac{1}{2}$. $4 \div \frac{1}{2} = ?$

a. Write the number that is to be divided: 4

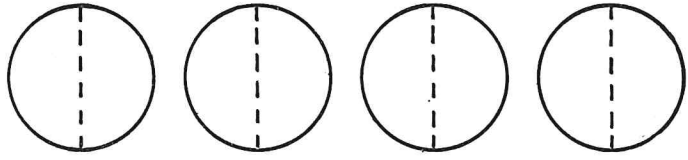
b. Change the $\div$ sign to a $\times$ sign: $4 \times$

c. Invert the divisor, $\frac{1}{2}$: $4 \times \frac{2}{1}$

d. Write the $=$ sign: $4 \times \frac{2}{1} =$

e. Work the example as a multiplication example:

$$4 \div \tfrac{1}{2} = 4 \times \tfrac{2}{1} = \tfrac{4 \times 2}{1} = \tfrac{8}{1} = 8$$



This picture shows that there are 8 half circles in four circles. Therefore $4 \div \frac{1}{2} = 8$. The work above is correct.

3. Study the examples below carefully. Then copy, and work them with your book closed.

a. $3 \div \frac{1}{3} = 3 \times \frac{3}{1} = \frac{3 \times 3}{1} = \frac{9}{1} = 9$

b. $3 \div \frac{3}{4} = 3 \times \frac{4}{3} = \frac{3 \times 4}{3} = \frac{12}{3} = 4$

c. $6 \div \frac{4}{5} = 6 \times \frac{5}{4} = \frac{6 \times 5}{4} = \frac{30}{4} = 7\frac{2}{4} = 7\frac{1}{2}$

Supply the missing numbers, and complete the work:

4. $6 \div \frac{2}{3} = 6 \times \frac{?}{2} = ?$

5. $7 \div \frac{3}{4} = 7 \times \frac{?}{3} = ?$

6. $8 \div \frac{4}{5} = 8 \times \frac{?}{?} = ?$

7. $5 \div \frac{2}{5} = 5 \times \frac{?}{?} = ?$

CHECKING ANSWERS IN DIVISION

1. Draw a line 3 inches long. Divide it into half-inch lengths. How many half-inch lengths are there in a 3-inch line? $3 \div \frac{1}{2} = ?$ Now work this example by division as explained on page 204. Are the answers the same?

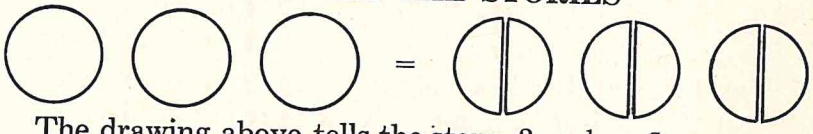
2. Draw a line 3 inches long. Divide it into lengths $\frac{3}{4}$-inch long. How many $\frac{3}{4}$-inch lengths are there in 3 inches? $3 \div \frac{3}{4} = ?$ Now work this example by division to check your work with the ruler.

3. Use your ruler to find how many $\frac{3}{4}$-inch lengths there are in a line that is 6 inches long. $6 \div \frac{3}{4} = ?$ Check your answer by division.

4. Use your ruler to find how many quarter inches there are in 2 inches. $2 \div \frac{1}{4} = ?$ Check your answer by division.

5. Tell the steps to take in working the example $4 \div \frac{2}{3}$.

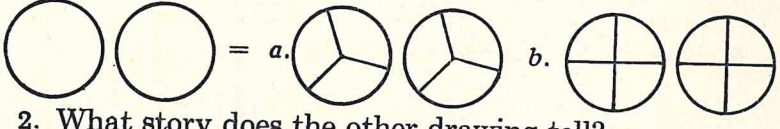
LET'S TELL THE STORIES



The drawing above tells the story, $3 \div \frac{1}{2} = 6$.

We think: $\frac{1}{2}$ is contained in 3 six times.

1. Which of the drawings below tell the story, $2 \div \frac{1}{4} = 8$?



2. What story does the other drawing tell?

3. Make drawings which tell the stories below:

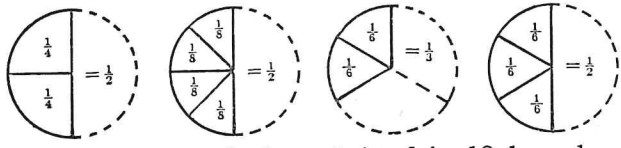
a. $3 \div \frac{1}{4} = 12$ *b.* $2 \div \frac{1}{2} = 4$ *c.* $3 \div \frac{3}{4} = 4$.

4. Show by division that the stories in problem 3 are correct.

5. Show by a drawing and also by division that $2 \div \frac{2}{3} = 3$.

DIVIDING A FRACTION BY A FRACTION

These drawings will help you to find the answers to examples in which you divide a fraction by a fraction.



1. How many times is $\frac{1}{4}$ contained in $\frac{1}{2}$? $\frac{1}{2} \div \frac{1}{4} = ?$

You can see that $\frac{1}{2} \div \frac{1}{4} = 2$; that is, that $\frac{1}{4}$ circle is contained in $\frac{1}{2}$ circle 2 times.

2. How many times is $\frac{1}{8}$ contained in $\frac{1}{2}$? $\frac{1}{2} \div \frac{1}{8} = ?$

3. $\frac{1}{3} \div \frac{1}{6} = ?$ 4. $\frac{1}{2} \div \frac{1}{6} = ?$

5. These four examples can be worked without using the drawings, as shown below:

a. $\frac{1}{2} \div \frac{1}{4} = \frac{1}{2} \times \frac{4}{1} = \frac{1 \times 4}{2 \times 1} = \frac{4}{2} = 2$	How do we get $\frac{4}{1}$?
b. $\frac{1}{2} \div \frac{1}{8} = \frac{1}{2} \times \frac{8}{1} = \frac{1 \times 8}{2 \times 1} = \frac{8}{2} = 4$	How do we get $\frac{8}{1}$?
c. $\frac{1}{3} \div \frac{1}{6} = \frac{1}{3} \times \frac{6}{1} = \frac{1 \times 6}{3 \times 1} = ?$	How do we get $\frac{6}{1}$?
d. $\frac{1}{2} \div \frac{1}{6} = \frac{1}{2} \times \frac{6}{1} = ?$	Complete the example.

You can see that to divide a fraction by a fraction you invert the divisor and multiply as you did in dividing a whole number by a fraction.

6. Study the work below carefully. Then copy the examples and work them with your book closed.

a. $\frac{1}{2} \div \frac{1}{3} = \frac{1}{2} \times \frac{3}{1} = \frac{3}{2} = 1\frac{1}{2}$

b. $\frac{1}{4} \div \frac{5}{6} = \frac{1}{\cancel{4}_{2}} \times \frac{\overset{3}{\cancel{6}}}{5} = \frac{3}{10}$

c. $\frac{1}{\cancel{4}_{1}} \div \frac{1}{\cancel{8}_{1}} = \frac{\overset{2}{\cancel{8}}}{1} = 2$

d. $\frac{\overset{1}{\cancel{5}}}{\cancel{8}_{4}} \div \frac{\overset{3}{\cancel{6}}}{\cancel{5}_{1}} = \frac{3}{4}$

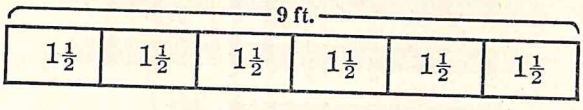
7. Work examples *b*, *c*, and *d*, without cancellation.

Divide:

	a	*b*	*c*	*d*	*e*
8.	$\frac{1}{2} \div \frac{1}{2} =$	$\frac{1}{3} \div \frac{1}{6} =$	$\frac{1}{4} \div \frac{3}{8} =$	$\frac{5}{6} \div \frac{2}{3} =$	$\frac{4}{5} \div \frac{4}{9} =$
9.	$\frac{3}{8} \div \frac{3}{5} =$	$\frac{3}{5} \div \frac{4}{5} =$	$\frac{1}{6} \div \frac{1}{2} =$	$\frac{7}{8} \div \frac{5}{6} =$	$\frac{9}{10} \div \frac{3}{5} =$

DIVIDING A WHOLE NUMBER BY A MIXED NUMBER

1. John had a board 9 feet long. He cut it into pieces each $1\frac{1}{2}$ feet long. How many pieces did he then have?



The drawing shows that $9 \div 1\frac{1}{2} = 6$.

We work the example $9 \div 1\frac{1}{2}$ like this:

$9 \div 1\frac{1}{2} =$

$9 \div \frac{3}{2} = 9 \times \frac{2}{3} = \frac{18}{3} = 6$

First change $1\frac{1}{2}$ to $\frac{3}{2}$. Then invert $\frac{3}{2}$ and multiply.
John then had 6 pieces.
Check: $6 \times 1\frac{1}{2} = 9$

In dividing a whole number by a mixed number, change the mixed number to an improper fraction. Then invert the divisor and multiply.

2. Study the following examples carefully:

a. $8 \div 3\frac{1}{3} = 8 \div \frac{10}{3} =$ $\quad$ *b.* $4 \div 6\frac{2}{3} = 4 \div \frac{20}{3} =$

$8 \times \frac{3}{10} = \frac{24}{10} = 1\frac{2}{5} = 2\frac{2}{5}$ $\quad$ $\frac{\overset{1}{\cancel{4}}}{1} \times \frac{3}{\cancel{20}_{5}} = \frac{3}{5}$

3. Which of the examples above shows that the answer may be a whole number? a fraction? a mixed number?

4. Copy and work the examples in 1 and 2 above. Find the answers. Check by multiplying:

	a	*b*	*c*	*d*
5.	$6 \div 1\frac{1}{2} =$	$20 \div 6\frac{2}{3} =$	$5 \div 1\frac{1}{4} =$	$8 \div 2\frac{2}{3} =$
6.	$9 \div 2\frac{3}{4} =$	$7 \div 3\frac{2}{3} =$	$6 \div 4\frac{1}{2} =$	$12 \div 4\frac{4}{5} =$
7.	$8 \div 4\frac{1}{2} =$	$5 \div 6\frac{2}{3} =$	$4 \div 7\frac{1}{5} =$	$2 \div 5\frac{1}{3} =$

MIXED PRACTICE

1.	$3 \div \frac{1}{2} =$	$\frac{3}{8} \div \frac{3}{4} =$	$5 \div \frac{3}{4} =$	$\frac{1}{2} \div \frac{1}{4} =$
2.	$3 \div 4\frac{1}{2} =$	$\frac{3}{4} \div \frac{3}{4} =$	$7 \div 1\frac{2}{5} =$	$6 \div 2\frac{1}{4} =$

CALORIES IN CERTAIN FOODS

	One Serving	Number Calories	Relative Number of Calories
Pork	4 oz.	402	
Beef	4 oz.	369	
Lamb	4 oz.	367	
Fowl	4 oz.	269	
Liver	4 oz.	177	
Fish	4 oz.	177	
Milk	7 oz. 1 glass	138	
Butter	$\frac{1}{2}$ oz.	107	
Nuts	$\frac{1}{2}$ oz.	100	
Bananas	$3\frac{1}{3}$ oz. 1 medium	96	
Vegetables	$3\frac{1}{2}$ oz.	89	
Cheese	$\frac{2}{3}$ oz.	89	
Cereals	$\frac{3}{4}$ oz. $\frac{1}{2}$ cup cooked	78	
Bread	1 oz. 1 slice	76	
Eggs	$1\frac{4}{5}$ oz. 1 egg	75	
Sugar	$\frac{1}{3}$ oz. 2 teaspoons	40	

CALORIES IN THE FOOD WE EAT

1. The calorie is the unit used in measuring the energy value of foods. The chart on page 208 shows the number of calories in one serving of the foods we commonly eat. Servings of which foods produce the greatest number of calories?

2. About how many calories are there in one serving of pork? in one ounce? in one pound?

3. How many calories are there in one ounce of butter? in one pound?

4. How many calories are there in one ounce of vegetables? in one pound?

5. How many teaspoonfuls of sugar are there in one ounce?

6. How many calories are there in one pound of sugar?

7. How much do two eggs weigh? How many calories do they produce?

8. Which contains more calories, one pound of beef or one pound of bread? How many more?

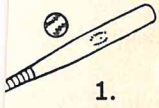
9. Use the table to find the number of calories a person would consume by eating the following foods:

a. Breakfast: bread, butter, eggs, milk, cereal, bananas.

b. Lunch: fish, bread, butter, vegetables, cheese.

c. Dinner: beef, bread, butter, vegetables, sugar, nuts.

*10. Find the total number of calories consumed during the three meals in problem 9.

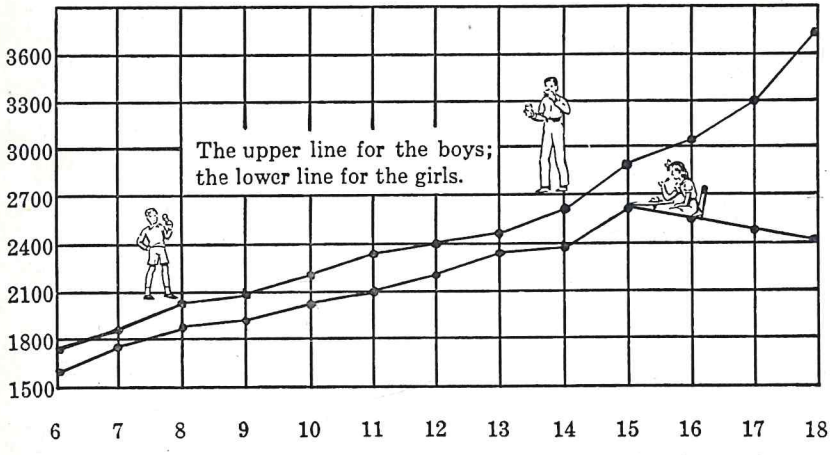


LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	$2\frac{1}{2} + 4\frac{5}{8}$	$7\frac{1}{2} - 4\frac{1}{3}$	$28 \times 5\frac{3}{4}$	$6\frac{3}{4} + 5\frac{2}{3}$	$12 \div 2\frac{2}{5} =$
2.	$\frac{3}{4} \div \frac{5}{8} =$	$9\frac{3}{4} - 2\frac{7}{8}$	$6\frac{3}{4} - 2\frac{7}{8}$	$4\frac{1}{2} \times 4\frac{2}{3} =$	$6 \times 1\frac{1}{4} =$

HOW MANY CALORIES DO YOU NEED?

The graph shows the number of calories needed each day by well-nourished boys and girls from ages 6 to 18 years.



1. About how many calories are needed daily by a boy 6 years of age? 10 years of age? 15 years of age?
2. About how many calories are needed daily by a girl 6 years of age? 10 years of age? 15 years of age?
3. About how many calories are required daily by a boy of 18 years? by a girl of 18 years?
4. As a boy grows in age from 6 to 18, what increase is there in the number of calories required daily?
5. As a girl grows in age from 6 to 18 years, how does the number of calories required daily increase?
6. At what age does a boy require about 2000 calories daily? When does a girl require 2000 calories?
7. How many calories are required by boys and girls of your age?
*8. Use the table on page 208 to make a list of food for a day that will yield the right number of calories for yourself.

DIVIDING MIXED NUMBERS BY FRACTIONS

1. Mrs. Jones had $3\frac{1}{4}$ lemons. She divided them into fourths. How many fourths did she get in all?

$3\frac{1}{4}$ lemons $3\frac{1}{4}$ lemons cut into $\frac{1}{4}$'s $3\frac{1}{4} \div \frac{1}{4} = ?$

We work the example $3\frac{1}{4} \div \frac{1}{4}$ like this:

$3\frac{1}{4} \div \frac{1}{4} =$ First change $3\frac{1}{4}$ to $\frac{13}{4}$.

$\frac{13}{4} \div \frac{1}{4} = \frac{13}{4} \times \frac{4}{1} = \frac{52}{4} = 13$ Then invert the divisor ($\frac{1}{4}$) and multiply. Explain the work at the left.

There are 13 fourths in $3\frac{1}{4}$ lemons.

2. In a box there were $5\frac{1}{2}$ pounds of candy. How many $\frac{1}{4}$-pound bags could be filled with this candy?

Divide the following:

	a	*b*	*c*	*d*
3.	$5\frac{1}{2} \div \frac{1}{2} =$	$\frac{3}{4} \div \frac{1}{4} =$	$6\frac{2}{3} \div \frac{5}{6} =$	$6\frac{1}{4} \div \frac{4}{5} =$
4.	$4\frac{1}{3} \div \frac{2}{3} =$	$2\frac{1}{2} \div \frac{3}{4} =$	$4\frac{4}{5} \div \frac{9}{10} =$	$6\frac{1}{2} \div \frac{5}{6} =$

5. How many pieces of board $1\frac{1}{2}$ feet long can be cut from a board $7\frac{1}{2}$ feet long? THINK: $7\frac{1}{2}$ ft. $\div$ $1\frac{1}{2}$ ft. $= ?$

$7\frac{1}{2} \div 1\frac{1}{2} = \frac{15}{2} \div \frac{3}{2} =$ First change the two mixed numbers to improper fractions. Then invert the divisor and multiply. Explain the work at the left.

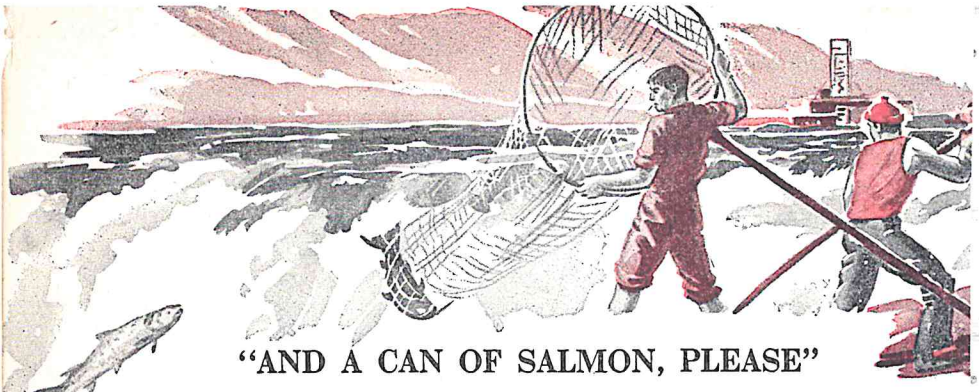
$\frac{15}{2} \times \frac{2}{3} = \frac{30}{6} = 5$

6. Study the work below until you are sure that you understand it. Then copy and work the examples.

a. $3\frac{2}{3} \div 2\frac{1}{2} = \frac{11}{3} \div \frac{5}{2} =$
$\frac{11}{3} \times \frac{2}{5} = \frac{22}{15} = 1\frac{7}{15}$

b. $1\frac{1}{4} \div 2\frac{1}{2} = \frac{5}{4} \div \frac{5}{2} =$
$\frac{5}{4} \times \frac{2}{5} = \frac{10}{20} = \frac{1}{2}$

	a	*b*	*c*	*d*
7.	$4\frac{1}{2} \div 2\frac{1}{4} =$	$6\frac{7}{8} \div 2\frac{1}{2} =$	$6\frac{2}{3} \div 3\frac{1}{3} =$	$9\frac{1}{2} \div 3\frac{1}{6} =$
8.	$4\frac{2}{3} \div 1\frac{2}{5} =$	$4\frac{1}{2} \div 1\frac{1}{8} =$	$4\frac{1}{5} \div 8\frac{3}{4} =$	$12\frac{1}{2} \div 2\frac{1}{2} =$
9.	$3\frac{1}{2} \div \frac{3}{4} =$	$9 \div 3\frac{3}{4} =$	$3\frac{1}{3} \div 6\frac{2}{3} =$	$4\frac{2}{3} \div 1\frac{2}{5} =$



"AND A CAN OF SALMON, PLEASE"

Tom visited a salmon cannery on the Columbia River last summer. Here are some problems he gave the class about things he saw there.

1. In a large tub there were 48 salmon. They weighed in all 1320 pounds. Find their average weight.

2. Tom's father caught a salmon in the river that weighed $78\frac{1}{4}$ pounds. How much more than the average weight of the salmon in the tub did his salmon weigh?

3. It takes a man about $1\frac{1}{2}$ minutes to clean a salmon. How many fish can he clean in an hour?

4. The cannery has a machine that cleans one fish a second. How many salmon can the machine clean in an hour?

5. A machine with knives cuts the salmon to fit the cans. A canning machine fills 75 cans every minute. How many cans can it fill in a 10-hour day?

6. In a recent year there were canned in the United States and Alaska about 364 million pounds of salmon valued at 52 million dollars. How many pounds was that to a dollar? THINK: $52\overline{)364} = ?$

*7. When the salmon are swimming upstream to spawn, the government does not permit fishing at certain times. Suppose that on two days of a week fishing is forbidden. What part of the salmon that might have been caught in a week would be expected to escape on these days?

DIVIDING A FRACTION BY A MIXED NUMBER

1. There is $\frac{3}{4}$ pound of sugar in $1\frac{1}{2}$ cups. How much does 1 cup of sugar weigh?

THINK: $\frac{3}{4} \div 1\frac{1}{2} = ?$

$\frac{3}{4} \div 1\frac{1}{2} =$

$\frac{3}{4} \div \frac{3}{2} = \frac{3}{4} \times \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$

Change $1\frac{1}{2}$ to $\frac{3}{2}$.
Then invert the divisor and multiply as in dividing by any fraction.

A cup of sugar weighs $\frac{1}{2}$ lb.

2. If $1\frac{1}{2}$ cups of flour weigh $\frac{3}{8}$ pound, find the weight of one cup.

THINK: $\frac{3}{8} \div 1\frac{1}{2} = ?$

Find the answers:

	a	*b*	*c*	*d*
3.	$\frac{2}{3} \div 1\frac{1}{2} =$	$\frac{3}{4} \div 1\frac{1}{5} =$	$\frac{5}{6} \div 1\frac{2}{3} =$	$\frac{7}{8} \div 1\frac{5}{6} =$
4.	$\frac{1}{2} \div 2\frac{1}{4} =$	$\frac{7}{8} \div 2\frac{4}{5} =$	$\frac{9}{10} \div 2\frac{1}{10} =$	$\frac{3}{5} \div 4\frac{1}{2} =$

WHAT IS WRONG?

Can you find the errors in these examples?

1. $3 \div 1\frac{1}{2} = 3 \div \frac{3}{2} =$
   $3 \times \frac{2}{3} = \frac{6}{3}$

2. $4\frac{1}{2} \div 1\frac{1}{5} = \frac{9}{2} \div \frac{6}{5} =$
   $\frac{2}{9} \times \frac{6}{5} = \frac{12}{45} = \frac{4}{15}$

3. $5\frac{1}{4} \div \frac{3}{7} = \frac{\cancel{21}^{3}}{4} \times \frac{3}{\cancel{7}} =$
   $\frac{9}{4} = 2\frac{1}{4}$

4. $6\frac{2}{3} \div 3\frac{1}{3} = \frac{19}{3} \times \frac{10}{3} =$
   $\frac{19}{3} \times \frac{3}{10} = \frac{19}{10} = 1\frac{9}{10}$

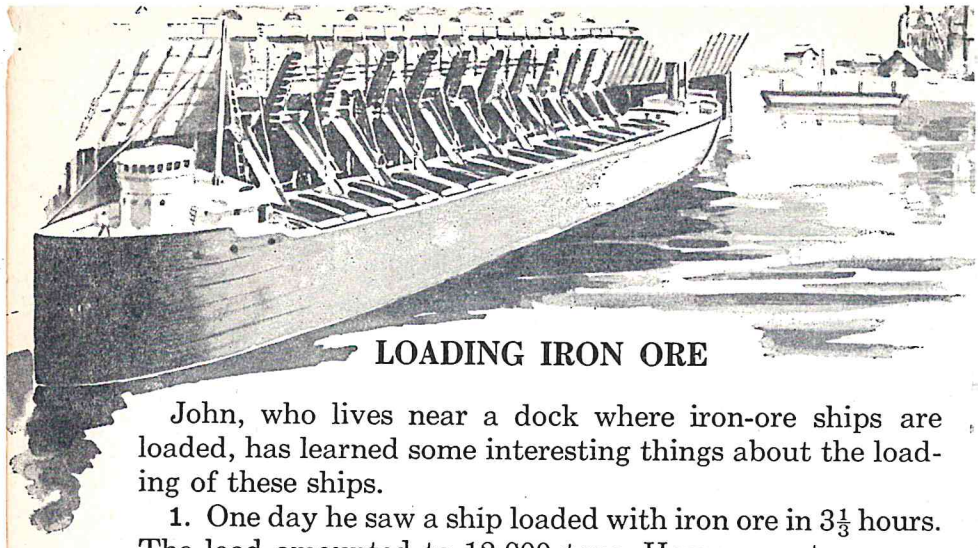
5. $\frac{1}{4} \div \frac{3}{8} = \frac{4}{1} \times \frac{8}{3} = \frac{32}{3} = 10\frac{2}{3}$

6. $1\frac{1}{4} \div 2\frac{1}{2} = \frac{5}{4} \div \frac{5}{2} =$
   $\frac{5}{4} \times \frac{2}{5} = \frac{10}{20} = 2$

Do you ever make errors like those shown above?

PRACTICE IN DIVISION OF FRACTIONS

	a	*b*	*c*	*d*
1.	$4 \div \frac{1}{2} =$	$6 \div \frac{2}{3} =$	$9 \div \frac{4}{5} =$	$1 \div \frac{2}{5} =$
2.	$5\frac{1}{2} \div \frac{1}{4} =$	$6\frac{1}{4} \div \frac{5}{6} =$	$4\frac{1}{6} \div 1\frac{2}{3} =$	$\frac{1}{2} \div \frac{1}{8} =$
3.	$2\frac{1}{2} \div 1\frac{1}{4} =$	$3\frac{1}{3} \div 13\frac{1}{3} =$	$\frac{1}{2} \div 1\frac{1}{2} =$	$3\frac{1}{2} \div 1\frac{5}{8} =$
4.	$\frac{2}{3} \div 1\frac{1}{6} =$	$7 \div 5\frac{1}{2} =$	$9 \div 3\frac{1}{3} =$	$10 \div 2\frac{1}{2} =$



LOADING IRON ORE

John, who lives near a dock where iron-ore ships are loaded, has learned some interesting things about the loading of these ships.

1. One day he saw a ship loaded with iron ore in $3\frac{1}{3}$ hours. The load amounted to 12,000 tons. How many tons were loaded in an hour? in a minute?

2. The record for loading a 12,000-ton boat is 16 minutes. How many tons is this a minute? an hour? The picture above will help you to understand how ships can be loaded so quickly. Can you explain the picture?

3. The average time for unloading such a ship is 6 hours. The record up to a recent year was 2 hours 25 minutes. How much less than the average time is this record?

4. Iron-ore boats often bring back loads of coal when they return to Duluth from the shores of Lake Erie. How much would it cost to ship 15,000 tons of coal on an iron-ore boat at $.45 a ton? It is cheaper to transport coal by ship than by rail. Why is this?

5. Look at a map of the United States in your geography book. Using the scale of miles, estimate the distance a boat of iron ore would travel in going from Duluth to Buffalo; from Duluth to Chicago.

*6. How long would it take an iron-ore boat, traveling at the rate of 12 miles an hour, to go between the ports mentioned in problem 5?

DIAGNOSTIC TEST IN DIVISION BY FRACTIONS

This test will help you to find the places in which you need more practice in division by fractions. Work the examples carefully. If you make more than one error in a row of examples, study again the material on the page given at the right of the row.

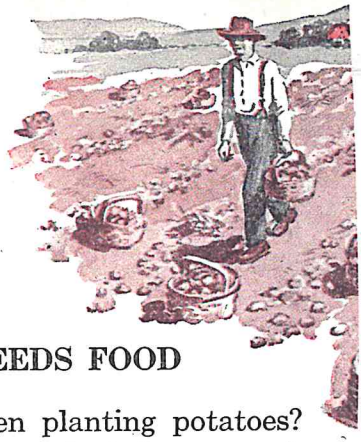
	a	*b*	*c*	*d*	
1.	$1 \div \frac{1}{3} =$	$3 \div \frac{1}{4} =$	$5 \div \frac{2}{3} =$	$6 \div \frac{3}{4} =$	(202)
2.	$\frac{1}{2} \div \frac{1}{4} =$	$\frac{1}{3} \div \frac{1}{6} =$	$\frac{3}{4} \div \frac{3}{5} =$	$\frac{5}{6} \div \frac{5}{8} =$	(206)
3.	$\frac{1}{3} \div \frac{1}{2} =$	$\frac{1}{4} \div \frac{3}{4} =$	$\frac{5}{6} \div \frac{7}{8} =$	$\frac{2}{3} \div \frac{3}{4} =$	(206)
4.	$3 \div 1\frac{1}{2} =$	$5 \div 1\frac{1}{4} =$	$4 \div 2\frac{2}{3} =$	$6 \div 3\frac{3}{5} =$	(207)
5.	$4 \div 5\frac{2}{5} =$	$6 \div 8\frac{1}{4} =$	$3 \div 4\frac{1}{3} =$	$5 \div 13\frac{1}{3} =$	(207)
6.	$5\frac{1}{2} \div \frac{1}{4} =$	$3\frac{1}{5} \div \frac{4}{5} =$	$4\frac{2}{3} \div \frac{5}{6} =$	$2\frac{1}{2} \div \frac{3}{4} =$	(211)
7.	$3\frac{2}{3} \div 2\frac{1}{2} =$	$7\frac{1}{2} \div 2\frac{1}{2} =$	$4\frac{4}{5} \div 6\frac{1}{5} =$	$1\frac{1}{8} \div 5\frac{1}{4} =$	(211)
8.	$\frac{2}{3} \div 1\frac{1}{3} =$	$\frac{3}{4} \div 1\frac{1}{2} =$	$\frac{7}{8} \div 1\frac{3}{4} =$	$\frac{4}{5} \div 3\frac{1}{2} =$	(213)

Do not be satisfied until you know how to work these examples correctly and easily.

*INTERESTING FACTS TO FIND OUT

If you do not need to practice on division by fractions, you may prepare a brief report on one of the topics below.

1. How the crops we produce are shipped.
2. The prices our farmers receive for crops today.
3. How our grandparents harvested the grain they raised.
4. Which is cheaper—trucks or railroads?
5. How airplanes are affecting the lives of people.
6. What our state is doing to protect wild animals.



EVEN THE GROUND NEEDS FOOD

Does it pay to use fertilizer when planting potatoes? To find out, one of our universities conducted an experiment. They divided a two-acre field in half. In Field A they planted potatoes using a fertilizer that cost \$6.50. In Field B they planted just as many potatoes, but they used no fertilizer. In the fall when the potatoes were harvested, it was found that Field A produced $180\frac{1}{2}$ bushels and Field B $119\frac{1}{4}$ bushels. The potatoes were sold for \$1.36 a bushel.

1. Which field produced more potatoes? How many more? Can you give reasons for the difference in the size of the two crops?

2. How much was received for the potatoes raised in Field A?

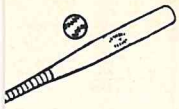
3. How much was received for the potatoes raised in Field B?

4. Find the difference in the amounts received for the potatoes.

5. When the cost of the fertilizer is subtracted from the difference, how much is left?

*6. Do you think it pays to use fertilizer in raising potatoes?

*7. Describe a way to find which of two kinds of potatoes used for seed will produce the larger crop.



LET'S PRACTICE

Set I

	a	*b*	*c*	*d*	*e*
1.	$\frac{1}{2} \times 3\frac{1}{3} =$	$3\frac{1}{2}$ $+2\frac{1}{2}$	$3\frac{1}{2} \div 1\frac{3}{4} =$	27 $-16\frac{1}{2}$	$6 \div 1\frac{1}{4} =$
2.	$20\overline{)9753}$	$7\frac{1}{2}$ $\times 6$	$9\frac{1}{2}$ $-6\frac{5}{6}$	\$8.56 $\times 500$	$\frac{1}{2}$ of $2\frac{2}{3} =$
3.	$4\frac{3}{4}$ $+6\frac{1}{2}$	724 $\times 860$	79.6 -25.8	16.475 $+9.536$	$18\overline{)1476}$
4.	$2\frac{1}{2} \div 1\frac{1}{9} =$	$8\frac{3}{4}$ $-2\frac{1}{6}$	$87\overline{)78735}$	$9\frac{7}{8}$ $+5\frac{2}{3}$	$38\overline{)25840}$

Set II

1.	536.9 89.8 724.6 7275.5 29.5 598.3	2. 205.27 -6.27	3. $9 \times 1\frac{5}{6} =$	4. $9\frac{5}{6}$ $+7\frac{3}{4}$
		5. 7 $-4\frac{2}{3}$	6. $7\frac{1}{2} \times 1\frac{1}{5} =$	7. $72\overline{)6336}$
		8. \$8.97 $\times 860$	9. $4\frac{2}{5} \div \frac{4}{5} =$	10. 608 $\times 709$

PROBLEMS TO READ AND SOLVE

1. Jack's father pays $19\frac{7}{10}$ cents a gallon for gasoline. If the $6\frac{1}{2}$-cent tax is subtracted from this price, how much is left of the price a gallon?

2. Change the fractions in problem 1 to decimals, and work the problem again. Which way do you like better?

3. The tuition for a dancing class is \$10.00 for 20 lessons. By paying in advance, $\frac{1}{10}$ is saved. What is the cost of the 20 lessons paid in advance?

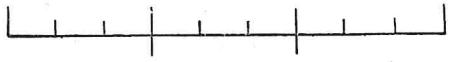
DIVIDING A WHOLE INTO EQUAL PARTS

1. This line is $2\frac{1}{2}$ inches long. It has been divided into

five equal parts. How long is each part? $2\frac{1}{2}'' \div 5 = \ ?$

Use the drawing to find out how much is $1\frac{1}{2} \div 3$?

2. This line is $2\frac{1}{4}$ inches long. It has been divided into 3 equal parts. How long is each part? $2\frac{1}{4}'' \div 3 = ?$

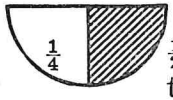


3. How much is $\frac{1}{3}$ of $2\frac{1}{4}$ inches? Does the example $2\frac{1}{4}'' \div 3$ have the same result as the example $\frac{1}{3}$ of $2\frac{1}{4}''$?

4. Draw a line $2\frac{1}{4}$ inches long. With your ruler divide it into 2 equal parts. How long is each part? $2\frac{1}{4}'' \div 2 = ?$

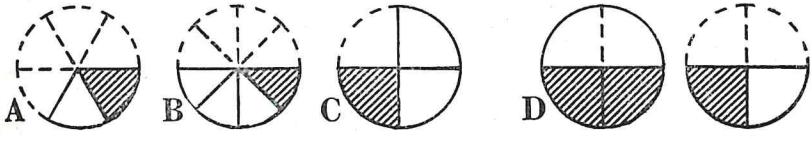
5. Cut a narrow slip of paper $1\frac{1}{2}$ inches long. Fold the paper lengthwise into two equal parts, that is, into halves. How long is each of the two parts? $1\frac{1}{2}'' \div 2 = ?$ $\frac{1}{2}$ of $1\frac{1}{2}'' = ?$

LET'S TELL THE STORIES



The drawing at the left tells the story, $\frac{1}{2} \div 2 = \frac{1}{4}$. We think: When $\frac{1}{2}$ is divided into two equal parts, each part equals $\frac{1}{4}$.

1. Which drawing below tells the story, $\frac{1}{2} \div 4 = \frac{1}{8}$? $1\frac{1}{2} \div 2 = \frac{3}{4}$?

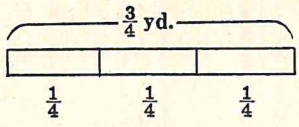


2. What stories do the other drawings tell?

3. Make drawings which tell the stories below:

a. $\frac{1}{4} \div 2 = \frac{1}{8}$ *b.* $\frac{3}{4} \div 2 = \frac{3}{8}$ *c.* $\frac{1}{2} \div 3 = \frac{1}{6}$

DIVIDING A FRACTION BY A WHOLE NUMBER



1. Alice had $\frac{3}{4}$ yard of lace. She wanted to divide it into 3 equal parts. How long should each piece be?

THINK: $\frac{3}{4} \div 3 = ?$

$\frac{3}{4} \div 3 = \frac{3}{4} \div \frac{3}{1} = \frac{3}{4} \times \frac{1}{3} = \frac{3}{12} = \frac{1}{4}$

Think of 3 as $\frac{3}{1}$. Invert $\frac{3}{1}$ and then multiply as shown at the left.

Each part should be $\frac{1}{4}$ yd. long.

Check: $3 \times \frac{1}{4} = \frac{3}{4}$

2. Study the examples below carefully:

a. $\frac{1}{2} \div 2 = \frac{1}{2} \div \frac{2}{1} = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

b. $\frac{3}{8} \div 6 = \frac{3}{8} \div \frac{6}{1} = \frac{3}{8} \times \frac{1}{6} = \frac{3}{48} = \frac{1}{16}$

When you understand the work, copy and work the examples with your book closed. Can you work example *b* by dividing before you multiply $\frac{3}{8} \times \frac{1}{6}$?

3. Supply the missing numbers and complete the examples:

a. $\frac{3}{4} \div 2 = \frac{3}{4} \times \frac{1}{?} =$

b. $\frac{5}{6} \div 4 = \frac{5}{6} \times \frac{1}{?} =$

c. $\frac{5}{8} \div 5 = \frac{5}{8} \times \frac{1}{?} =$

d. $\frac{4}{5} \div 2 = \frac{4}{5} \times \frac{1}{?} =$

To divide a fraction or a mixed number by a whole number, multiply by the inverted form of the whole number.

Find the answers to the following:

	a	*b*	*c*	*d*
4.	$\frac{1}{2} \div 4 =$	$\frac{2}{3} \div 3 =$	$\frac{5}{6} \div 2 =$	$\frac{4}{5} \div 2 =$
5.	$\frac{5}{8} \div 5 =$	$\frac{3}{4} \div 3 =$	$\frac{2}{3} \div 2 =$	$\frac{1}{2} \div 3 =$
6.	$\frac{4}{5} \div 4 =$	$\frac{1}{2} \div 6 =$	$\frac{3}{8} \div 3 =$	$\frac{7}{8} \div 4 =$

7. Jack swam $\frac{1}{8}$ mile in 10 minutes. How far did he swim in 1 minute?

8. Mary's mother found that 6 eggs weigh $\frac{3}{4}$ pound. What is the average weight of each egg?

DIVIDING MIXED NUMBERS BY WHOLE NUMBERS

1. Mary has $1\frac{1}{2}$ cups of pineapple juice. She wishes to divide it into two equal parts. How much should there be in each part? How much is $1\frac{1}{2} \div 2$?

This is $1\frac{1}{2}$ cups.

This is $1\frac{1}{2}$ cups $\div$ 2.

Show that $1\frac{1}{2} \div 2 = \frac{3}{4}$.

We work the example, $1\frac{1}{2} \div 2$, like this:

$1\frac{1}{2} \div 2 = 1\frac{1}{2} \div \frac{2}{1} =$
$1\frac{1}{2} \times \frac{1}{2} = \frac{3}{2} \times \frac{1}{2} = \frac{3}{4}$

You know that to divide a number by 2 is the same as finding $\frac{1}{2}$ of the number. Therefore dividing $1\frac{1}{2}$ by 2 is the same as finding $\frac{1}{2}$ of it. There will be $\frac{3}{4}$ cup in each part.

If you think of 2 as $\frac{2}{1}$, you can see that $\frac{1}{2}$ is the inverted form of $\frac{2}{1}$, or the inverted form of 2. So you can see that **to divide by a whole number, you invert the whole number and then multiply.** Show by reduction that $\frac{2}{1}$ is 2.

2. Study the following examples carefully:

a. $2\frac{2}{3} \div 2 = 2\frac{2}{3} \div \frac{2}{1} =$
$\frac{8}{3} \times \frac{1}{2} = \frac{8}{6} = 1\frac{2}{6} = 1\frac{1}{3}$

b. $1\frac{1}{4} \div 5 = 1\frac{1}{4} \div \frac{5}{1} =$
$\frac{5}{4} \times \frac{1}{5} = \frac{5}{20} = \frac{1}{4}$

Copy the examples and work them with your book closed.

3. What are the missing numbers? Complete the work.

a. $5\frac{1}{2} \div 4 = \frac{11}{2} \times \frac{1}{?} =$
b. $1\frac{1}{2} \div 6 = \frac{3}{2} \times \frac{1}{?} =$
c. $6\frac{1}{4} \div 5 = \frac{25}{4} \times \frac{1}{?} =$
d. $4\frac{1}{2} \div 9 = \frac{9}{2} \times \frac{1}{?} =$

Divide:

	a	*b*	*c*	*d*
4.	$7\frac{1}{2} \div 3 =$	$5\frac{1}{2} \div 4 =$	$7\frac{2}{3} \div 6 =$	$4\frac{3}{4} \div 2 =$
5.	$3\frac{1}{3} \div 2 =$	$5\frac{1}{4} \div 3 =$	$6\frac{2}{3} \div 5 =$	$7\frac{3}{5} \div 4 =$
6.	$1\frac{1}{4} \div 7 =$	$2\frac{1}{2} \div 5 =$	$4\frac{3}{8} \div 7 =$	$4\frac{3}{4} \div 6 =$

7. Harry had 4 puppies. They weighed in all $5\frac{1}{2}$ pounds. What was their average weight?

THINGS TO REMEMBER ABOUT DIVIDING FRACTIONS

1. Be sure that you change the $\div$ sign to $\times$ and that you invert the **divisor.** Which number do you invert in these examples?

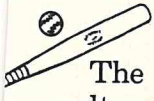
$\frac{1}{2} \div \frac{1}{4} =$ $\quad$ $2\frac{1}{2} \div 3\frac{1}{3} =$ $\quad$ $\frac{1}{4} \div 2 =$

2. Before you can invert a mixed number, you must change it to an improper fraction. Then you can invert it. Show that the inverted form of $1\frac{1}{2}$ is $\frac{2}{3}$.

3. You can think of any whole number as an improper fraction with a denominator of 1. Thus, $2 = \frac{2}{1}$. The inverted form of 2 or $\frac{2}{1}$ is $\frac{1}{2}$.

$$4\tfrac{1}{2} \div 2 = 4\tfrac{1}{2} \div \tfrac{2}{1} = \tfrac{9}{2} \times \tfrac{1}{2} = \tfrac{9}{4} = 2\tfrac{1}{4}$$

4. After the divisor has been inverted, proceed as in the multiplication of fractions. To save time, divide before you multiply whenever possible.

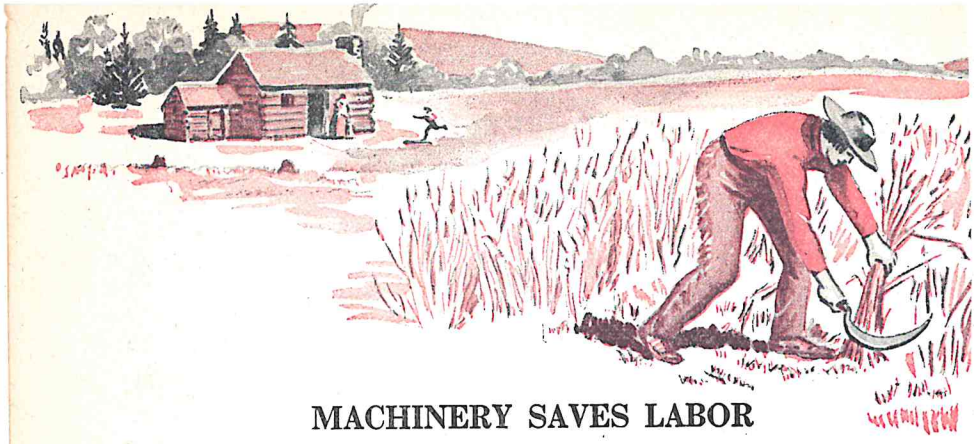


LET'S PRACTICE

The twelve division examples below were the most difficult ones in a test of forty examples given to a large number of boys and girls in your grade. How many of them can you work correctly?

	a	*b*	*c*	*d*
1.	$\frac{5}{12} \div 1\frac{5}{6} =$	$\frac{1}{3} \div 1\frac{1}{2} =$	$3\frac{1}{3} \div 1\frac{3}{4} =$	$5\frac{3}{5} \div 2 =$
2.	$1\frac{3}{8} \div \frac{3}{10} =$	$\frac{5}{6} \div \frac{3}{10} =$	$1\frac{1}{3} \div 3\frac{1}{3} =$	$3\frac{3}{8} \div 1\frac{1}{4} =$
3.	$\frac{1}{5} \div 5 =$	$5 \div 2\frac{3}{4} =$	$1\frac{1}{5} \div 4 =$	$4\frac{1}{2} \div 2\frac{1}{4} =$

Which of these examples did you not work correctly? Can you tell the reasons for your errors? The lesson on page 224 will help you to find the kinds of errors boys and girls often make in division of fractions.



MACHINERY SAVES LABOR

1. It is estimated that it took $64\frac{1}{4}$ hours to produce an acre of wheat by the hand methods used by the pioneers. In 1930 it took only $2\frac{1}{3}$ hours. Find the difference in time required. Why did it take so much less time in 1930?

2. It took pioneers about $6\frac{2}{3}$ hours to plow a field with oxen. Today it takes only $\frac{5}{6}$ hour to plow a field with a tractor. How much less time does it take today to plow a field with a tractor?

3. It took a pioneer about 16 hours to cut an acre of wheat with a sickle. Today it takes only $\frac{1}{2}$ hour to cut an acre of wheat with a big combine. How many acres can be cut by a combine in the time it took a man to cut an acre with a sickle?

4. It took a pioneer 46 hours to cut and thresh the wheat from an acre. Today a combine can cut and thresh the wheat from an acre in $\frac{1}{2}$ hour. Find the difference in the time required in pioneer days and today to thresh a 10-acre field of wheat.

5. In 1855 it took $38\frac{1}{2}$ hours to produce an acre of corn by hand methods. Today it takes only $5\frac{1}{2}$ hours. Find the difference in the time required.

6. How many times as long as it takes today did it take in 1855 to produce an acre of corn?

7. In 1855 it took $6\frac{1}{2}$ hours to plant an acre of corn by hand. With a tractor it takes $\frac{1}{4}$ hour to plant an acre of corn today. How much less time does it take today to plant an acre of corn with a tractor than it took by hand?

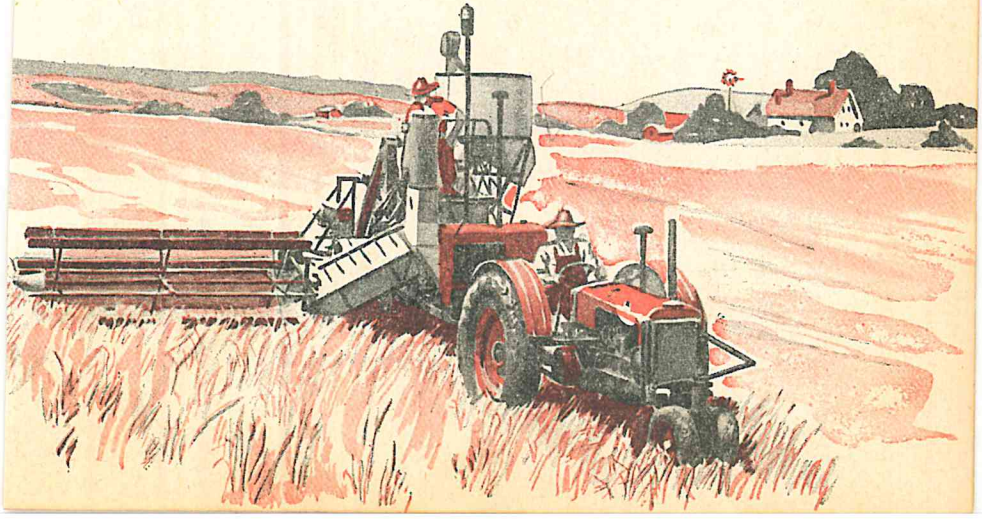
8. How many acres of corn can be planted by a tractor in the time it took to plant an acre by hand?

9. Today it takes $2\frac{1}{3}$ hours of labor to produce an acre of wheat and $5\frac{1}{2}$ hours of labor to produce an acre of corn. How much more time does it take to produce an acre of corn than to produce an acre of wheat?

10. How many times as long as it takes to produce an acre of wheat does it take to produce an acre of corn?

*11. A combine can cut a 16-foot swath of wheat each time it goes around a field. An acre is equal to a square about 208 feet long and 208 feet wide. About how many times would a combine have to go around such a field to mow the wheat on it? Draw a picture showing the path the combine would take.

*12. Name some labor-saving machines that we find on farms. What effect do these machines have on life on farms? on the number of workers on farms? Find out something about the history of combines, reapers, tractors, and cotton gins.



FINDING REASONS FOR ERRORS IN DIVIDING FRACTIONS

The examples below contain the kinds of errors that are made most frequently by boys and girls in division of fractions. Study each example and find the kinds of errors made. Then work the example correctly. Make a list of the kinds of errors you find. Do you ever make these kinds of errors?

1. $1\frac{1}{4} \times 1\frac{1}{8} =$

   $\frac{5}{4} \times \frac{9}{8} = \frac{45}{32} = 1\frac{11}{32}$

2. $4\frac{2}{3} \div \frac{5}{6} =$

   $\frac{14}{\cancel{3}} \times \frac{\overset{2}{\cancel{6}}}{5} = \frac{28}{5} = 5\frac{1}{5}$

3. $\frac{2}{3} \div \frac{1}{4} =$

   $\frac{3}{2} \times \frac{1}{4} = \frac{3}{8}$

4. $6 \div 1\frac{4}{5} =$

   $\frac{\overset{3}{\cancel{6}}}{1} \times \frac{5}{\underset{4}{\cancel{8}}} = \frac{15}{4}$

5. $4\frac{1}{2} \div 3 =$

   $\frac{9}{2} \times \frac{3}{1} = \frac{29}{2} = 14\frac{1}{2}$

6. $3\frac{1}{8} \div 1\frac{1}{4} =$

   $\frac{\overset{5}{\cancel{25}}}{\underset{2}{\cancel{8}}} \times \frac{\overset{1}{\cancel{4}}}{\cancel{5}} = 5$

PRACTICE IN FINDING ERRORS

Work these examples carefully. When you have completed a set of examples, try to find the reasons for any errors you made. Try not to repeat any kind of error.

Set I

	a	*b*	*c*	*d*
1.	$\frac{1}{2} \div \frac{1}{4} =$	$2\frac{1}{2} \div 2 =$	$\frac{1}{2} \div \frac{1}{2} =$	$\frac{1}{3} \div \frac{2}{3} =$
2.	$\frac{1}{6} \div \frac{1}{8} =$	$7\frac{1}{2} \div 2\frac{1}{2} =$	$4\frac{1}{5} \div 7 =$	$7\frac{1}{8} \div 5 =$
3.	$1\frac{1}{8} \div 1\frac{1}{8} =$	$4\frac{2}{3} \div 3\frac{5}{6} =$	$\frac{1}{4} \div \frac{1}{2} =$	$6\frac{2}{3} \div 3\frac{1}{3} =$

Set II

1.	$2\frac{1}{2} \div 4 =$	$3\frac{1}{2} \div 7 =$	$5\frac{1}{2} \div \frac{3}{4} =$	$1\frac{1}{2} \div 5\frac{1}{2} =$
2.	$\frac{2}{3} \div \frac{3}{4} =$	$3 \div \frac{1}{4} =$	$6\frac{3}{8} \div 3 =$	$\frac{1}{2} \div 2 =$
3.	$5 \div 6\frac{2}{3} =$	$\frac{3}{5} \div 4 =$	$8 \div 1\frac{1}{3} =$	$5\frac{2}{5} \div \frac{3}{5} =$

CHANGING MAGIC SQUARES

1. See if the square at the right is a magic square.

$7\frac{1}{2}$	1	$\frac{1}{2}$	6
2	$4\frac{1}{2}$	5	$3\frac{1}{2}$
4	$2\frac{1}{2}$	3	$5\frac{1}{2}$
$1\frac{1}{2}$	7	$6\frac{1}{2}$	0

2. You have found that multiplying the numbers in a magic square by the same number left a magic square. Let us see if dividing the numbers of a magic square by the same number leaves a magic square. First make a square on your paper with sixteen cells, like the one at the right above. Then divide each number in the magic square by 2 and write the result beside the number in your square. Then by adding the numbers in the square, find out if your square is a magic square. Be sure that all of your work is correct.

3. Repeat the above exercise with the squares below. This time divide by $\frac{1}{2}$, 4, or some other number. Then find out if you still have a magic square.

4	$\frac{3}{4}$	$\frac{1}{2}$	$3\frac{1}{4}$
$1\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4}$	2
$2\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	3
1	$3\frac{3}{4}$	$3\frac{1}{2}$	$\frac{1}{4}$

$3\frac{1}{5}$	$\frac{3}{5}$	$\frac{2}{5}$	$2\frac{3}{5}$
1	2	$2\frac{1}{5}$	$1\frac{3}{5}$
$1\frac{4}{5}$	$1\frac{1}{5}$	$1\frac{2}{5}$	$2\frac{2}{5}$
$\frac{4}{5}$	3	$2\frac{4}{5}$	$\frac{1}{5}$

4. Does dividing the numbers of a magic square by the same number change the square so that it is no longer a magic square?

5. You have now learned four ways of changing a magic square. Take some magic square and change it in these four ways so that you will have four different magic squares.

*THE COST OF TRANSPORTING WHEAT

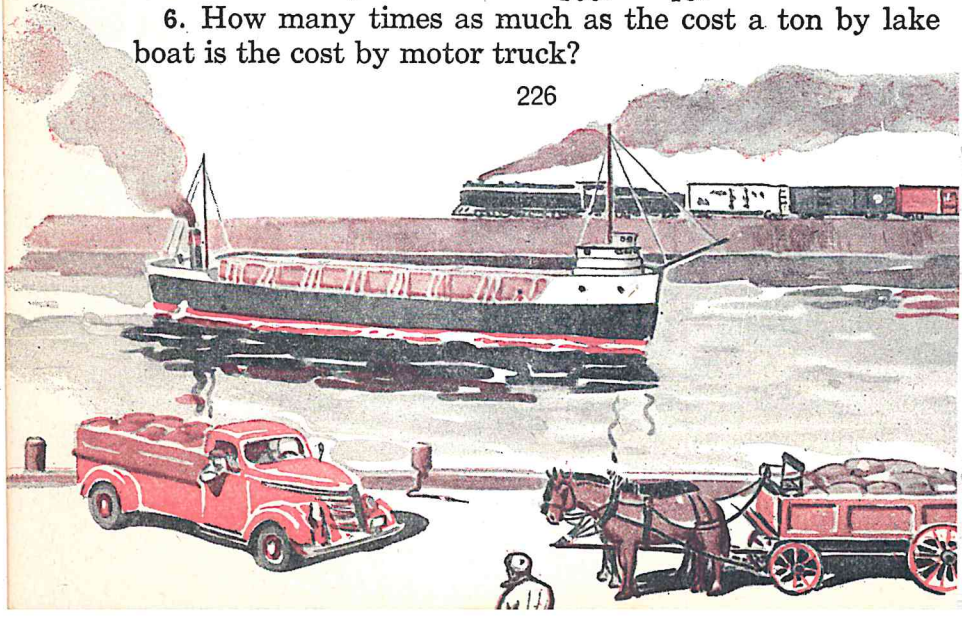
Wheat is shipped in many different ways. It is taken to market by the farmer in a wagon or motor truck. Railways carry it to milling centers. Much grain is also shipped in canal and lake boats. Wheat is also carried across the ocean in big ocean freighters.

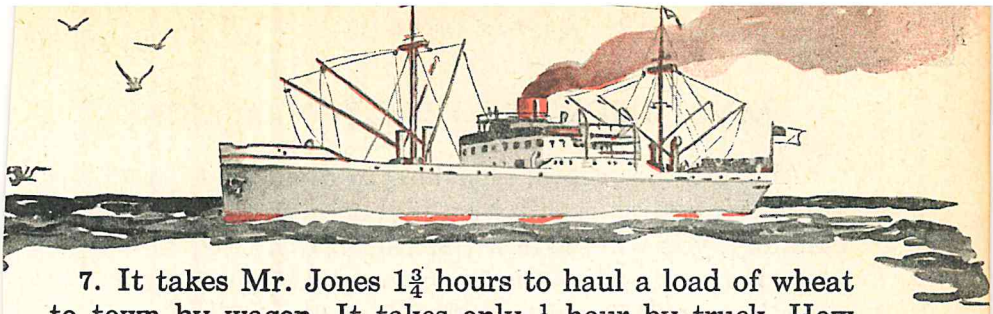
The cost of transporting a ton of wheat a mile by each of these methods is estimated to be as follows:

Wagon 30¢	Railway $\frac{67}{100}$¢
Motor truck 16¢	Lake and canal boats $\frac{2}{5}$¢

Ocean freighters $\frac{1}{10}$¢

1. Which of these ways costs the most?
2. Which of these ways costs the least?
3. How much more does it cost to carry a ton of wheat a mile by rail than by ocean freighter?
4. How much less does it cost to carry a ton of wheat a mile by ocean freighter than by lake boat? Which kind of boat usually travels farther with a load of wheat?
5. How many times as much as the cost on ocean freighters is the cost by rail? THINK: $\frac{67}{100}¢ \div \frac{1}{10}¢ = ?$
6. How many times as much as the cost a ton by lake boat is the cost by motor truck?





7. It takes Mr. Jones $1\frac{3}{4}$ hours to haul a load of wheat to town by wagon. It takes only $\frac{1}{4}$ hour by truck. How many times as long as it takes by truck does it take by wagon? How many times as much as the cost by truck is the cost by wagon?

8. The distance from New York to England is about 3800 miles. How much would it cost to transport a shipload of 20,000 bushels of wheat from New York to England?

9. What would be the cheapest way to transport 10,000 bushels of wheat from Duluth, Minnesota, to Buffalo, New York?

DIAGNOSTIC TEST IN DIVISION OF FRACTIONS

This test will help you to find weak spots you may have in division of fractions. If you make more than one error in a row of examples, turn back for help to the page given at the end of the line. Do not be satisfied until you can work every kind of example correctly.

	a	*b*	*c*	*d*	
1.	$4 \div \frac{1}{2} =$	$5 \div \frac{2}{3} =$	$3 \div \frac{3}{5} =$	$7 \div \frac{3}{4} =$	(202)
2.	$\frac{1}{2} \div \frac{1}{4} =$	$\frac{1}{3} \div \frac{1}{3} =$	$\frac{3}{5} \div \frac{3}{5} =$	$\frac{5}{6} \div \frac{1}{6} =$	(206)
3.	$\frac{1}{2} \div \frac{3}{4} =$	$\frac{1}{4} \div \frac{2}{3} =$	$\frac{3}{6} \div \frac{5}{8} =$	$\frac{2}{3} \div \frac{5}{6} =$	(206)
4.	$\frac{1}{2} \div \frac{1}{3} =$	$\frac{1}{4} \div \frac{1}{8} =$	$\frac{7}{8} \div \frac{2}{3} =$	$\frac{9}{10} \div \frac{3}{5} =$	(206)
5.	$6 \div 1\frac{1}{3} =$	$9 \div 2\frac{1}{4} =$	$5 \div 6\frac{2}{3} =$	$4 \div 5\frac{1}{2} =$	(207)
6.	$\frac{3}{4} \div 1\frac{1}{2} =$	$\frac{2}{3} \div 1\frac{1}{3} =$	$\frac{5}{6} \div 2\frac{1}{4} =$	$\frac{5}{6} \div 1\frac{1}{5} =$	(211)
7.	$2\frac{1}{2} \div 1\frac{1}{4} =$	$3\frac{1}{2} \div 2\frac{1}{2} =$	$5\frac{1}{4} \div 1\frac{1}{6} =$	$3\frac{1}{3} \div 4\frac{1}{6} =$	(211)
8.	$\frac{1}{3} \div 2 =$	$\frac{3}{4} \div 3 =$	$\frac{2}{3} \div 4 =$	$\frac{5}{6} \div 5 =$	(219)
9.	$3\frac{1}{2} \div 4 =$	$8\frac{3}{4} \div 5 =$	$6\frac{1}{2} \div 3 =$	$4\frac{4}{5} \div 10 =$	(220)

*ANOTHER WAY TO DIVIDE FRACTIONS

Alice's father showed her how to divide with fractions without inverting the divisor. If you study the work below carefully, you will see how this can be done.

1. How many times is 5 cents contained in 20 cents?

THINK: $20¢ \div 5¢ = 20 \div 5 = 4$

2. How many times is $\frac{1}{4}$ contained in $\frac{5}{4}$?

THINK: Five fourths will contain one fourth as often as 5 will contain 1.

$\frac{5}{4} \div \frac{1}{4} = 5 \div 1 = 5$

3. Prove by inverting and then multiplying that $\frac{5}{4} \div \frac{1}{4}$ equals 5.

4. Use the method described in 2 to find the answer to the example $\frac{4}{5} \div \frac{2}{5}$. Check by inverting and multiplying.

5. To find the answer to the example $\frac{3}{4} \div \frac{1}{2}$, first change the fractions to the same denominator.

$\frac{3}{4} \div \frac{1}{2} = \frac{3}{4} \div \frac{2}{4} = 3 \div 2 = 1\frac{1}{2}$

Check this answer by inversion.

6. The work below shows how to use this method to divide $3\frac{1}{2}$ by $\frac{3}{4}$.

$3\frac{1}{2} \div \frac{3}{4} = \frac{7}{2} \div \frac{3}{4} = \frac{14}{4} \div \frac{3}{4} = 14 \div 3 = 4\frac{2}{3}$

Is this answer correct? Check by inversion.

7. Explain how to solve by this method the example $3\frac{1}{3} \div 2\frac{1}{2}$.

8. Use the method described above to work these examples:

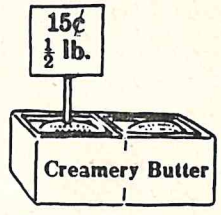
a. $1\frac{3}{4} \div \frac{1}{4}$ *b.* $2\frac{1}{2} \div 1\frac{1}{4}$ *c.* $3\frac{3}{4} \div 1\frac{1}{5}$ *d.* $4 \div 1\frac{1}{3}$

To divide fractions or mixed numbers by fractions or mixed numbers, first change the numbers to fractions having the same denominator. Then divide the numerators of the fractions to find the answer.

9. Use this method to work the examples on page 221.

FINDING THE WHOLE WHEN A PART IS GIVEN

1. Julia paid 15 cents for $\frac{1}{2}$ pound of butter. At that rate how much would 1 pound of butter cost?



THINK: There are two half pounds in a whole pound.
So 1 pound will cost two times as much as $\frac{1}{2}$ pound.
One pound will cost 2 $\times$ 15¢, or ? cents.

2. How many fourths are there in a whole? How many eighths? How many sixths?

3. At 20 cents for $\frac{1}{4}$ pound of tea, how much does 1 pound of tea cost?

4. At 18 cents for $\frac{1}{3}$ yard, how much does 1 yard of ribbon cost?

5. If $\frac{1}{2}$ dozen eggs cost 18 cents, how much is the price a dozen?

6. At a sale Jack bought a bat for 75 cents. This was $\frac{1}{2}$ of the regular price. What was the regular price?

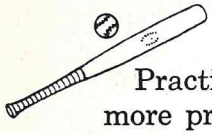
THINK: 75¢ = $\frac{1}{2}$ of what number?
The whole number = 2 times $\frac{1}{2}$ of the number.
The regular price = 2 $\times$ 75¢, or $1.50.

7. On a spelling test Jane missed 5 words. This was $\frac{1}{4}$ of the words in the test. How many words were there in the test?

8. John has saved $1.25. This is $\frac{1}{4}$ of the amount he needs to buy a football. How much is he planning to pay for the football?

Find the missing numbers in the examples below:

9. 4 = $\frac{1}{2}$ of (?)
10. 9 = $\frac{1}{3}$ of (?)
11. 10 = $\frac{1}{4}$ of (?)
12. 6 = $\frac{1}{5}$ of (?)
13. 7 = $\frac{1}{8}$ of (?)
14. 15 = $\frac{1}{2}$ of (?)
15. 25 = $\frac{1}{4}$ of (?)
16. 66 = $\frac{1}{3}$ of (?)
17. $ .25 = $\frac{1}{5}$ of (?)
18. $ .75 = $\frac{1}{3}$ of (?)
19. $ .90 = $\frac{1}{2}$ of (?)
20. $3.75 = $\frac{1}{8}$ of (?)



LET'S PRACTICE

Practice one set of these examples a day. If you need more practice, work the same set of examples on several days. Keep a record of your scores to see if your work improves.

Set I

1. $\begin{array}{r} 9.742 \\ 8.556 \\ 48.393 \\ .042 \\ 6.754 \\ 29.835 \\ \hline \end{array}$

2. $\begin{array}{r} 796.4 \\ -253.6 \\ \hline \end{array}$

3. $\begin{array}{r} 295 \\ \times 37 \\ \hline \end{array}$

4. $\begin{array}{r} 9\frac{1}{2} \\ +7\frac{3}{4} \\ \hline \end{array}$

5. $\begin{array}{r} 8\frac{1}{2} \\ -3\frac{1}{4} \\ \hline \end{array}$

6. $\frac{2}{3} \times \frac{3}{4} =$

7. $64\overline{)2752}$

8. $\begin{array}{r} 8 \\ \times 2\frac{3}{4} \\ \hline \end{array}$

9. $7 \div 2\frac{4}{5} =$

10. $48\overline{)3744}$

Set II

1. $\begin{array}{r} 37.85 \\ 147.46 \\ 8.96 \\ 7.03 \\ 656.89 \\ .94 \\ \hline \end{array}$

2. $\begin{array}{r} 80367 \\ -29158 \\ \hline \end{array}$

3. $\begin{array}{r} 479 \\ \times 500 \\ \hline \end{array}$

4. $\begin{array}{r} 6\frac{3}{4} \\ +8\frac{7}{8} \\ \hline \end{array}$

5. $\begin{array}{r} 6\frac{2}{3} \\ -1\frac{5}{6} \\ \hline \end{array}$

6. $4 \times \frac{5}{6} =$

7. $56\overline{)3248}$

8. $\begin{array}{r} 9\frac{1}{2} \\ \times 6 \\ \hline \end{array}$

9. $2\frac{1}{2} \div 5 =$

10. $26\overline{)2061}$

USING THE VOCABULARY OF ARITHMETIC

Write sentences showing how to use the words below. Be ready to read them to the class.

cancellation	units	menu	tally	invert
expenses	combine	wages	hundredth	score
account	license	bill	freight	billion
denominator	acre	calorie	lowest terms	quartette

USING WHAT YOU HAVE LEARNED

1. At a sale Paul bought a bicycle for \$16. This was $\frac{4}{5}$ of the regular price. What was the regular price?

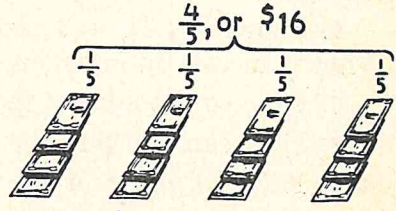
THINK: $\frac{4}{5}$ of the regular price = \$16.

One fifth of the regular price = $\frac{1}{4}$ of \$16, or \$4.

$\frac{5}{5}$, the whole of the regular price, = 5 × \$4 = \$20.

Check: $\frac{4}{5}$ of \$20 = \$16.

Study the illustration. It will help you to understand why $\frac{1}{5}$ of the regular price is $\frac{1}{4}$ of \$16. Notice the number of rows of dollars which make $\frac{4}{5}$.



2. If $\frac{3}{4}$ pound of sausage costs 21 cents, how much does a whole pound cost?

THINK: $\frac{3}{4}$ lb. costs 21¢. $\frac{1}{4}$ lb. costs $\frac{1}{3}$ of 21¢, or 7¢. $\frac{4}{4}$ lb. costs 4 × 7¢, or 28¢.

3. In an arithmetic test Arthur worked 15 examples correctly. This was $\frac{3}{4}$ of all of the examples in the test. How many examples were there in the test?

4. One year Mr. Jones raised only 10 bushels of wheat to the acre because of damage done by insects and lack of rain. This is only $\frac{2}{3}$ of the crop he usually produces. How many bushels an acre does he usually produce?

THINK: 10 bu. = $\frac{2}{3}$ of what number?

Tell what number is missing in each example below:

5. 6 = $\frac{2}{3}$ of (?)
6. 8 = $\frac{2}{3}$ of (?)
7. 9 = $\frac{3}{4}$ of (?)
8. 2 = $\frac{2}{3}$ of (?)
9. 6 = $\frac{3}{4}$ of (?)
10. 18 = $\frac{2}{3}$ of (?)
11. \$60 = $\frac{2}{3}$ of (?)
12. \$80 = $\frac{4}{5}$ of (?)
13. \$90 = $\frac{5}{8}$ of (?)

14. A baseball team won 24 games. This was $\frac{3}{5}$ of all of the games the team played. How many games did the team play? How many games did the team lose?

15. Four fifths of what number is 8? 16? 32? 40? 80? 120?

HOW WELL DO YOU REMEMBER?

1. Give the place value of each figure in the number 3,758,421.

2. Which is most, .37, .4, or .275? How can you tell?

3. In what ways are multiplication and division of fractions alike?

4. Show that $4\frac{1}{2} \div 3$ and $\frac{1}{3}$ of $4\frac{1}{2}$ give the same results. What is meant by inverting the divisor?

5. Give to the nearest foot: $5\frac{3}{4}$ ft.; $7\frac{1}{3}$ ft.; 8.5 ft.

6. How can you find the area of a garden?

7. How do you find the whole of a number when you know part of the number? $18 = \frac{2}{3}$ of what number?

8. How do you find what part 8 is of 24?

9. How do you find $\frac{3}{5}$ of a number? $\frac{3}{5}$ of $48 = ?$

10. Give each step in working these examples:

a. $5\frac{1}{3} \div 4 =$ *b.* $6 \div \frac{4}{5} =$ *c.* $8\frac{1}{3} \div 2\frac{1}{2} =$

INFORMATION PLEASE!

1. How is the food value of the things we eat measured?

2. What is meant by "importing"? by "exporting"?

3. Why is it necessary for us to take steps to conserve the supply of oil?

4. How does our government raise money with which to protect our wild fowl and animals?

5. How does money help people to live together?

6. Why is it important for the people of a country to have standard units of measurement that are the same for all parts of the country?

7. What are some industries in which fast means of transportation are necessary?

MEASURING GROWTH IN PROBLEM SOLVING

1. How much does $\frac{1}{2}$ pound of cookies cost at 30¢ a pound?

2. John is 5 feet 8 inches tall. Patty is 4 feet 6 inches tall. How much taller than Patty is John?

3. At a $\frac{1}{4}$-off sale Mary's mother bought her an $8 dress. How much did she pay for the dress?

4. Ann saw some 25-cent handkerchiefs on sale at 18 cents each. How much would Ann save by buying 6 handkerchiefs at the sale?

5. On an automobile trip Will's father drove 1,218 miles in 28 hours. How many miles did he average an hour?

6. Helen has 10 yards of ribbon. How many pennants can she make if she needs $1\frac{1}{4}$ yards of ribbon for each pennant?

7. Cans of fruit are on sale at 3 cans for $.50. How much would a dozen cans cost at this rate?

8. Ben worked $3\frac{1}{2}$ hours in a neighbor's garden in the morning and $2\frac{3}{4}$ hours in the afternoon. How much did he earn if he was paid 20 cents an hour?

9. A carpenter has a board 9 feet 7 inches long. He cuts off two pieces, one 1 foot 6 inches long, the other 3 feet 8 inches long. How long is the piece of board that is left?

10. If $\frac{3}{4}$ pound of bacon costs 27 cents, how much does one pound of bacon cost?

What Your Score Means

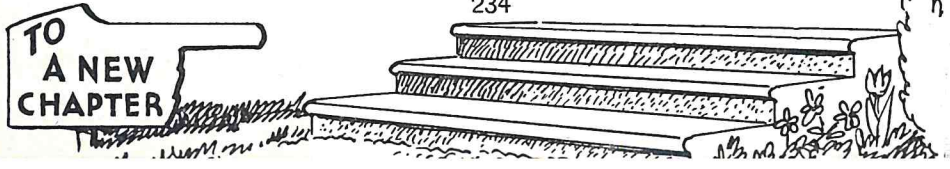
Unsatisfactory	Fair	Good	Excellent
0 1 2 3 4	5 6	7 8	9 10

UP THE STEPS TO A NEW CHAPTER

This test will help you to find out how well you know the arithmetic you have studied. When you copy the numbers, be sure to leave enough space for your work.

1. Subtract: 9 ft. 4 in. − 4 ft. 8 in. (156)
2. Find the product of 860 × 947. (59)
3. Divide 50331 by 57. (77)
4. Divide 12240 by 18. Check your answer. (96)
5. Add: 29.8 + 6.7 + 984.2 + .6 = ? (42)
6. Subtract 29.64 from 38.84. Check by addition. (49)
7. How much is $6\frac{5}{8} + 7\frac{1}{2} + 9\frac{3}{4}$? (114)
8. Add these numbers: $9\frac{3}{4} + 6\frac{2}{3} + 8\frac{1}{2} = ?$ (121)
9. How much less than $8\frac{1}{2}$ yards is $6\frac{1}{3}$ yards? (140)
10. Subtract $3\frac{1}{2}$ hours from $7\frac{1}{8}$ hours. (144)
11. How much is $\frac{3}{4} \times \frac{6}{15}$? Divide before you multiply. (180)
12. Reduce to improper fractions: $2\frac{1}{3}$; $6\frac{3}{4}$; $8\frac{5}{6}$. (183)
13. Find the product of $3\frac{1}{3} \times 7\frac{1}{2}$. (185)
14. Multiply 24 by $8\frac{3}{4}$. (170)
15. Find $\frac{3}{5}$ of 70. (170)
16. What part of a yard is 2 feet? (24)
17. If $\frac{3}{4}$ pound of butter costs 30 cents, how much does 1 pound cost? (229)
18. How many $\frac{3}{4}$-pound bags of candy are there in 12 pounds? (202)
19. How much is $1\frac{1}{4}$ divided by $1\frac{2}{3}$? (211)
20. Divide $12\frac{1}{2}$ by 5; check by multiplication. (220)

After your paper has been marked, correct your errors at once. If necessary, turn for help to the pages given at the right of the test. Do not go on to the next chapter until you can work every example in the test correctly.



CHAPTER VIII

TRAVEL TO SOUTH AMERICA

Ann looked up the cost of steamship and airplane fares to Buenos Aires, Argentina, from New York. Here are some facts she found:

1. The fare by steamer from New York at that time was $330 one way, or $545 round trip. How much would a traveler save by buying a round-trip ticket rather than one ticket to Buenos Aires and another ticket back to New York? What is the fare today? Is there a tax?

2. A steamer leaving New York on July 18 reached Buenos Aires on August 5. How many days did it take to make the trip?

3. The fare by Clipper from New York to Buenos Aires was $621.75 one way, or $1119.20 round trip. How much would be saved by buying a round-trip airplane ticket instead of one ticket to Buenos Aires and another ticket back to New York? In 1946 the fare was $547 one way and $984.60 round trip. Why did the fares come down in price?

4. The trip by airplane took 5 days. How much less time was this than the time for the trip by steamer? Why is the fare by steamer so much less than the fare by airplane? Why might people go by airplane rather than by steamer?

*5. The time from June 1 to August 14 is called the "off season." Fewer tourists travel at that time than at other times. Why are tourist less likely to travel to South America during those months than at other times?

ANNEXING ZEROS TO DECIMALS

1. How do the three decimals, .4, .40, and .400 compare in value?

THINK: .4 = 4 tenths
.40 = 4 tenths, 0 hundredths
.400 = 4 tenths, 0 hundredths, 0 thousandths

You can see that these three decimals have the same value.

2. Show that the fractions $\frac{4}{10}$ and $\frac{40}{100}$ have the same value. Show that $\frac{4}{10}$ can be changed to $\frac{400}{1000}$.

3. Write the decimal .3 on your paper. Write a 0 after the decimal. Does this change the value of the decimal?

4. Show that .3, .30, and .300 have the same value.

5. Show that .25 and .250 have the same value.

This work shows that **we may annex a zero to a decimal without changing the value of the decimal.**

6. We may write five dollars in two ways, \$5 or \$5.00. Write four dollars in two ways.

7. Show that 1.0 equals 10 tenths.

8. Is 2.7 feet the same as 2.70 feet?

THINK: $2.7 = 2\frac{7}{10}$
$2.70 = 2\frac{70}{100} = 2\frac{7}{10}$
Therefore 2.7 ft. = 2.70 ft.

9. Express these decimals as hundredths: .7, .6, 1.5, 1.0, 3.8, 5.0.

10. Express these decimals as thousandths: .17, .2, 1.0, 3.2, 5.49.

11. Which is more, .6 or .575?

THINK: .6 = .600. So .6 is more than .575.

12. Which is more, .5 or .35? .25 or .275? .825 or .9?

13. Which is most, .3, .17, or .087?

14. Which is most, .175, .040, or .3?

DECIMAL PARTS LESS THAN THE WHOLE

1. Charles read on a food chart that .09 of an orange is sugar. What part is not sugar?

A	B
1.	1.00
−.09	−.09
	.91

THINK: 1 orange − .09 orange = ?
You cannot subtract .09 from 1 until 1 is expressed as hundredths. (See A)
You know that 1 = 1.00 or 100 hundredths.
Subtract .09 from 1.00. (See B)
.91 of an orange is not sugar.

2. Show by subtracting $1 - \frac{9}{100}$ that .91 is the correct answer when subtracting .09 from 1.

3. Charles also read that .88 of an egg is water. What part of an egg is not water?

4. Dorothy read that .9 of all automobile accidents involve passenger automobiles. What part does not?

5. On a spelling test Florence missed .25 of the words. What part of the words did she spell correctly?

6. How much less than a mile is .875 mile?

7. How much less than a minute is .60 minute?

*8. How much less than the whole of a number is .27 of the number? .50 of the number?

ANOTHER WAY TO READ DECIMALS

1. Read this decimal: 31.278.

Business men have found that an easier and more accurate way to read such a number is as follows:

Three one **point** two seven eight.

The word **point** shows where the decimal point is.

2. Read these decimals in two ways:

6.98 4.007 26.137 506.789 86.091

3. Write the numbers from dictation. Your teacher will dictate them both ways. Which way seemed easier?

DECIMAL FRACTIONS AND OUR NUMBER SYSTEM

People in Europe knew how to write whole numbers like 496 and common fractions like $\frac{1}{10}$ long before decimal fractions were invented.

1. In writing whole numbers such as 111 each 1 has ten times the value of the 1 to its right. What is the value of the 1 at the right? the middle 1? and third 1?

2. In the mixed number $11\frac{1}{10}$ is the $\frac{1}{10}$ written in a place that has any value? What is the place value of the 1 in 24.1?

We can see that common fractions do not have any place value. We can think of them as an *addition* to the number system used in writing whole numbers.

3. In the number 11.1 each 1 has $\frac{1}{10}$ the value of the 1 to its left. Show that this is true.

About 300 years ago a great thinker said, "If we can give value to the places to the left of one's place, why should we not also give values to the places to the right of one's place?" Then he showed that we could write $11\frac{1}{10}$ as 11·1 (11.1). He placed the dot (decimal point) above the 1 in one's place to show the one's place. The value of the 1 to the left of one's place is ten; the value of the 1 to the right of one's place is tenth.

4. What is the place value of the 2 in 21.43? the 1? the 4? the 3?

5. What is the denominator of the mixed number, $21\frac{43}{100}$? Read this mixed decimal, 21.43. What is the denominator of the .43? Why is it not necessary to write the denominators of decimal fractions? How do you tell what the denominator of a decimal fraction is?

*6. Why can we say that the use of decimal fractions is an *extension* of our number system?

READINESS TEST FOR MULTIPLICATION OF DECIMALS

You are about to begin the study of multiplication of decimals. This test will help you to find out if you are ready for this new work.

I. Multiply these numbers.

1.	2.	3.	4.	5.
486	543	795	970	876
×25	×608	×793	×540	×800

II. Multiply. Be sure to point off dollars and cents.

1.	2.	3.	4.	5.
\$3.20	\$.68	\$5.01	\$.06	\$.03
×5	×7	×4	×9	×3

III. Find the answers by addition.

1. How much is 2.7 + 2.7 + 2.7?
2. How much is 3 times 4.8?
3. How much is 2 times 3.97?
4. How much is 4 times .128?

IV. Estimating answers.

1. Is 6 × \$3.15 nearer \$12, \$18, or \$22?
2. Is 7 × \$4.28 nearer \$23.26, \$26.40, or \$29.50?
3. Is 8 × \$9.80 nearer \$80, \$72, or \$90?
4. Is 9 × \$8.90 nearer \$72.50, \$80.20, or \$95.08?
5. Is 7 × \$12.88 nearer \$84, \$90, or \$78?
6. Is 10 × \$12.78 nearer \$125, \$1250, or \$180?

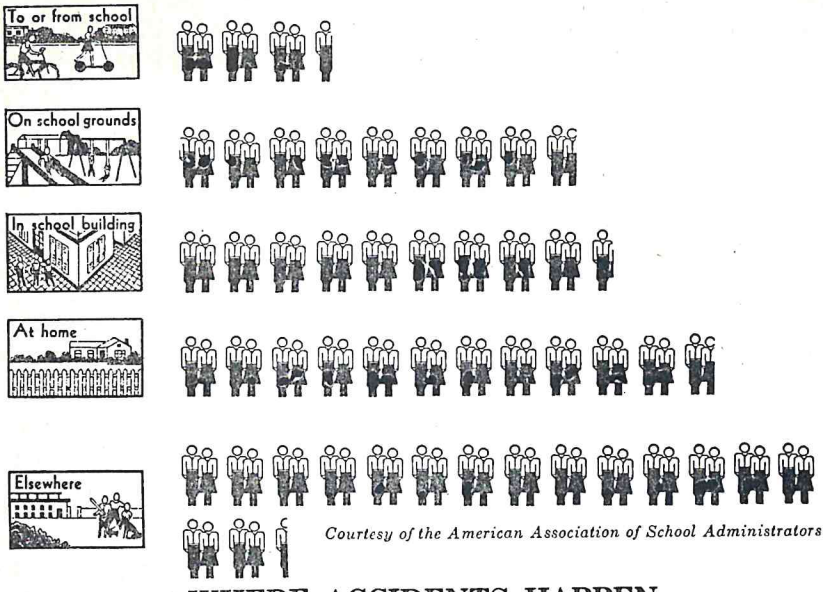
V. Expressing fractions as decimals:

1. Express as decimals:

$\frac{3}{10}$ $\frac{18}{100}$ $\frac{173}{1000}$ $4\frac{6}{10}$ $10\frac{9}{10}$

Find the products by multiplying fractions. Then express the products as decimals.

	a	*b*	*c*	*d*
2.	$\frac{7}{10} \times 9 =$	$3 \times \frac{7}{10} =$	$\frac{1}{10} \times \frac{3}{10} =$	$1\frac{7}{10} \times \frac{3}{10} =$
3.	$\frac{19}{100} \times 3 =$	$7 \times 1\frac{19}{100} =$	$\frac{3}{100} \times 3\frac{1}{10} =$	$1\frac{1}{10} \times 2\frac{1}{10} =$



Courtesy of the American Association of School Administrators

WHERE ACCIDENTS HAPPEN

The picture graph above shows where accidents to school children take place. The drawing of each child in the chart stands for 2 accidents out of a hundred.

1. How many drawings should there be to picture 100 accidents if each drawing stands for 2 accidents?

2. Name the places shown in the picture graph where accidents happen.

3. Where do most accidents take place? How does the chart help you to tell?

4. About how many accidents out of a hundred occur on the way "to or from school"? on school playgrounds? in school buildings? at home? elsewhere? What kinds of accidents can happen in each of these places?

*5. Some of the drawings of boys and girls in the graph are not complete. What does this mean? See if there are enough pictures to show in all a hundred accidents.

SAFETY FIRST FOR PEOPLE WALKING

Where do accidents happen most frequently? Why do they take place? The problems below will help you to answer these questions. The facts are for a recent year.

1. Many accidents to people traveling on foot happened at street intersections (crossings). The numbers below show how many out of every 100 accidents occurred at intersections, and when the accidents happened.

When Crossing with Signals	3.9 out of 100
When Crossing against Signals	11.4 out of 100
When Crossing with No Signal	14.2 out of 100
When Crossing Diagonally	1.6 out of 100

When did most accidents take place at street intersections?

2. How many accidents out of each 100 occurred at street intersections? How many occurred at other places?

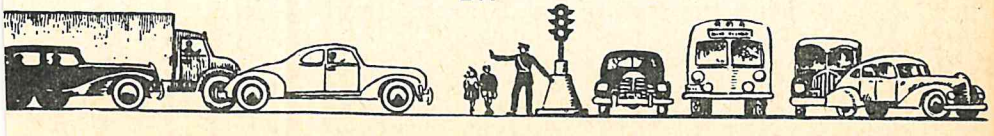
3. How many more occurred when people crossed against the signals than when they crossed with the signals?

4. Out of every hundred accidents 13.4 happened when children were playing in the street, 12.5 happened when people came from behind parked cars, and 28.6 happened when people crossed the street between intersections. How many accidents took place in these three ways?

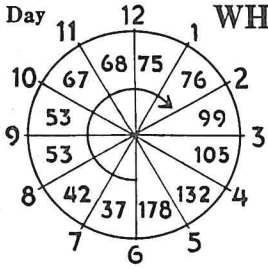
5. In questions 1 and 4 are listed seven things that caused accidents. List these reasons in order, beginning with the cause of the largest number of accidents. Then find how many accidents out of 100 occurred for these seven reasons.

6. How many out of 100 took place for other reasons?

*7. Make a list of safety rules, based on the facts given in the above problems. Can you give other reasons for accidents?

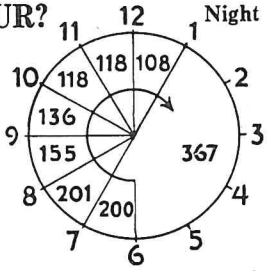


WHEN DO ACCIDENTS OCCUR?



START 6 A. M.

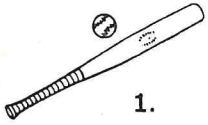
The clocks show the number of people who were killed at different hours of the day in a recent year in one of our large eastern states. In 198 other accidents the hour was not known.



START 6 P. M.

Study the clocks to answer these questions:

1. How many people were killed in the daytime from 6 to 7? from 7 to 8? How many in all were killed in the daytime from 6 A. M. to 6 P. M.?
2. How many more were killed at night than in the daytime?
3. On this day how many in all were killed in the state?
4. What was the most dangerous hour in the day? Was from 7 to 8 at night a more dangerous hour?
*5. What is being done to reduce the number of accidents?



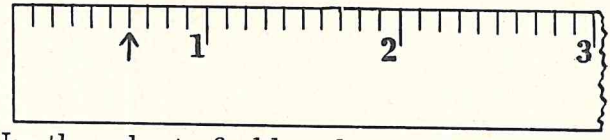
LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	$3\frac{1}{2}$ $+2\frac{1}{4}$	$9\frac{1}{4}$ $-6\frac{3}{4}$	$6\frac{1}{4}$ $\times 5$	$\frac{2}{5}=\frac{?}{10}$	$\frac{3}{4}\div\frac{2}{3}=$
2.	9.875 $-.253$	$4\times\frac{3}{4}=$	7.8 $+9.2$	$6\frac{1}{2}$ $+7\frac{2}{3}$	$\frac{1}{10}\times\frac{7}{10}=$
3.	$\frac{3}{10}\times 8=$	$9\times 2\frac{1}{3}=$	$8-2\frac{1}{2}=$	$\frac{1}{8}\div\frac{1}{4}=$	$6\div 2\frac{2}{3}=$
4.	$14\frac{1}{6}$ $-7\frac{3}{8}$	9.6 $+8.3$	$8\frac{5}{6}$ $+7\frac{3}{4}$	$3\frac{3}{10}\times 4\frac{7}{10}=$	$7\frac{1}{2}\div 5=$

5. Find the sum of 7.6, 97.5, 8.4, and 125.2.

USING A RULER TO MULTIPLY DECIMALS

How does this piece of ruler differ from most rulers? You can use the ruler to learn how to multiply decimals. Study the work below carefully



1. Use the ruler to find how long .2 in. + .2 in. + .2 in. is.

2. You know that .2 + .2 + .2 is the same as 3 × .2, because you are adding the same number three times. How much is 3 × .2?

3. Use the ruler to find how much 3 × .3 inch is.

4. How much more than 1 inch is 4 × .3 inch?

5. How much is 5 × .2 inch?

You can see that 1.0 inch is the same as 1 inch.

6. How much is 4 × .5 inch? Check by multiplying with fractions.

THINK: 4 × .5 in. = ? 4 × $\frac{5}{10}$ = ?

7. How much is 3 × .7 inch? Check by multiplying with fractions.

Give the products. Use the ruler when necessary.

	a	*b*	*c*	*d*
8.	2 × .4 =	5 × .2 =	2 × 1.1 =	3 × 1.0 =
9.	2 × .3 =	6 × .3 =	2 × 1.4 =	2 × 1.5 =

You can see that when you multiply a number containing tenths by a whole number, you should point off tenths in the answer. Thus, 3 × 3.4 = 10.2.

10. Prove by addition of decimals that 3 × 3.7 equals 11.1.

11. Show by addition of fractions that 2 × 7.9 = 15.8.

FINDING REASONABLE ANSWERS

1. John lives 1.6 miles from school. How far does he walk each day to and from school?

$$\begin{array}{r} 1.6 \\ \times 2 \\ \hline 3.2 \end{array}$$

THINK: 2×1.6 mi. $= ?$

You can see after multiplying 16×2, which gives 32, that he walks 32 miles, 3.2 miles, or .32 miles. You must decide where to place the decimal point in the answer. You can see that 1.6 miles is a little less than 2 miles; so the answer must be a little less than 2 times 2 miles, or 4 miles. So 3.2 miles must be the answer, since it is a little less than 4 miles.

2. Prove by addition that 2×1.6 miles is 3.2 miles. $1.6 + 1.6 = ?$

3. If an automobile goes a mile in 1.25 minutes, in how many minutes can it go 3 miles?

$$\begin{array}{r} 1.25 \\ \times 3 \\ \hline 3.75 \end{array}$$

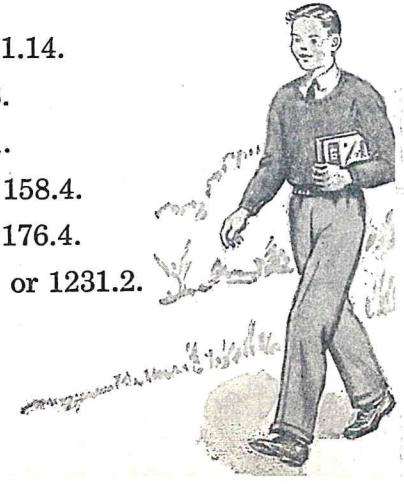
THINK: 3×1.25 min. $= ?$

Since the automobile can go a mile in a little more than a minute, it can go 3 miles in about 3 minutes. Therefore, a reasonable answer is 3.75 minutes. Prove by addition that this answer is correct.

4. The product of 4 and 123 is 492. What is the only reasonable product of 4×12.3? Would it be 492, 49.2, 4.92, or .492? Check your estimate by addition.

Tell which you think is the reasonable answer to each of these examples. Explain why.

5. $4 \times 2.85 = 114.0$, 11.40, or 1.14.
6. $5 \times 18.6 = 930$, 93.0, or 9.3.
7. $7 \times 6.3 = 441$, 44.1, or 4.41.
8. $9 \times 1.76 = 1.584$, 15.84, or 158.4.
9. $6 \times 29.4 = 1.764$, 17.64, or 176.4.
10. $8 \times 15.39 = 12.312$, 123.12, or 1231.2.



MULTIPLYING DECIMALS

1. Jack's father bought 4 new automobile tires at $16.35 each. How much did he pay for the four tires?

$$\begin{array}{r} \$16.35 \\ \times 4 \\ \hline \$65.40 \end{array}$$

Be sure to point off dollars and cents in the product. Is the decimal point placed correctly in the answer?

2. In one week 1.36 inches of rain fell. At that rate how much rain would fall in 4 weeks?

$$\begin{array}{r} 1.36 \\ \times 4 \\ \hline 5.44 \end{array}$$

THINK: 4×1.36 in. $= ?$

In multiplying a decimal by a whole number, multiply just as in multiplying dollars and cents. Because we multiplied a decimal containing hundredths, we point off two places in the answer.

5.44 inches of rain would fall in 4 weeks.

3. Prove that the answer to problem 2 is correct by finding the sum of four 1.36's.

4. In one hour Jack rode 12.7 miles on his bicycle. At that rate how far would he ride in 2 hours?

$$\begin{array}{r} 12.7 \\ \times 2 \\ \hline 25.4 \end{array}$$

THINK: 2×12.7 mi. $= ?$

How do we get 254? We multiplied a decimal containing tenths by 2. So we point off one place in the answer. Jack would ride 25.4 miles in 2 hours.

5. Show by addition that the answer to 4 is correct.

6. Study these examples. Explain each step in the work. Tell why the decimal points are placed where they are.

a. $\begin{array}{r} 2.47 \\ \times 8 \\ \hline 19.76 \end{array}$ *b.* $\begin{array}{r} 6.4 \\ \times 5 \\ \hline 32.0 \end{array}$ *c.* $\begin{array}{r} 20.04 \\ \times 7 \\ \hline 140.28 \end{array}$ *d.* $\begin{array}{r} .2 \\ \times 4 \\ \hline .8 \end{array}$ *e.* $\begin{array}{r} .94 \\ \times 2 \\ \hline 1.88 \end{array}$

7. Copy and work the examples with your book closed.

8. Tell where the decimal point should be placed in these products. Be ready to read the answers.

a. $\begin{array}{r} 3.04 \\ \times 6 \\ \hline 1824 \end{array}$ *b.* $\begin{array}{r} 3.9 \\ \times 5 \\ \hline 195 \end{array}$ *c.* $\begin{array}{r} .9 \\ \times 8 \\ \hline 72 \end{array}$ *d.* $\begin{array}{r} .84 \\ \times 7 \\ \hline 588 \end{array}$ *e.* $\begin{array}{r} 27.46 \\ \times 9 \\ \hline 24714 \end{array}$

A HELP IN MULTIPLYING DECIMALS

1. What is the product of 4 × 3.26?

3.26
×4
13.04

Multiply 3.26 by 4. Point off hundredths in the product. How many decimal places are there in 3.26? How many decimal places are there in 13.04?

2. You can see that there are as many decimal places in the product as there are in the number being multiplied.

See if this statement is also true for the examples under 6 on page 245.

In multiplying a decimal by a whole number, point off as many places in the product as there are decimal places in the number being multiplied.

3. Apply this rule to the following examples:

a.	*b.*	*c.*	*d.*	*e.*
3.68	3.2	2.478	.4	.02
×4	×8	×2	×2	×3
14.72	25.6	4.956	.8	.06

PRACTICE IN MULTIPLYING DECIMALS

Find the products. Be sure to place the decimal points in the answers correctly.

	a	*b*	*c*	*d*	*e*	*f*
1.	27.1	46.2	6.32	2.46	2.036	1.27
	×2	×9	×5	×6	×8	×7
2.	9.416	.496	7.46	84.7	9.86	35.7
	×4	×80	×3	×60	×10	×800
3.	219	48.9	6.28	4.96	54.1	.802
	×10	×85	×70	×27	×90	×14
4.	5.91	956	3.75	7.95	7.501	90.12
	×69	×600	×41	×100	×85	×30
5.	6.98	8.054	.247	85.3	7.95	.738
	×790	×72	×100	×203	×700	×96

HOW FAR CAN YOU SEE AT SEA?

How far can a person see at sea? Can you see as far at the edge of the ocean as you can at the top of a lighthouse that is 500 feet high? Visibility, or the distance one can see, varies according to the height one stands above sea level.

The table below shows you how far a person can see at various heights above the ocean.

Height	Visibility in Miles	Height	Visibility in Miles
5 feet	2.96	100 feet	13.23
10 feet	4.18	200 feet	18.71
25 feet	6.61	350 feet	24.75
50 feet	9.35	500 feet	29.58

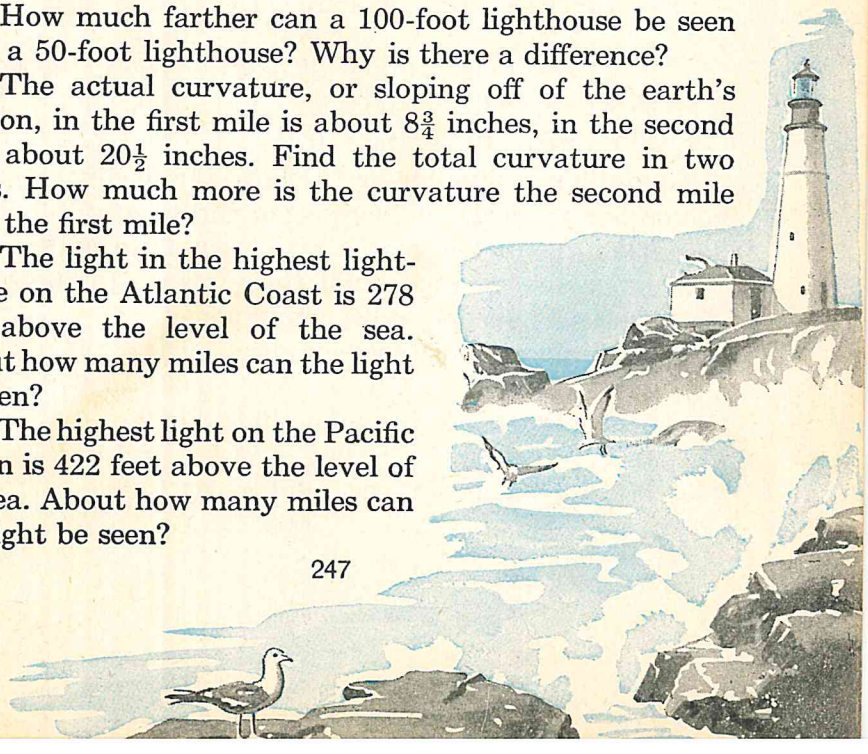
1. How much farther can you see at the seaside from a porch 10 feet above the level of the ocean than from a porch 5 feet above the ocean?

2. How much farther can a 100-foot lighthouse be seen than a 50-foot lighthouse? Why is there a difference?

3 The actual curvature, or sloping off of the earth's horizon, in the first mile is about $8\frac{3}{4}$ inches, in the second mile about $20\frac{1}{2}$ inches. Find the total curvature in two miles. How much more is the curvature the second mile than the first mile?

*4. The light in the highest lighthouse on the Atlantic Coast is 278 feet above the level of the sea. About how many miles can the light be seen?

*5. The highest light on the Pacific Ocean is 422 feet above the level of the sea. About how many miles can the light be seen?



MULTIPLYING DECIMALS BY 10, 100, AND 1000

A short method of multiplying decimals by 10, 100, and 1000 is explained below.

1. Multiply 3.75 by 10, 100, and 1000.

3.75	3.75	3.75
×10	×100	×1000
37.50	375.00	3750.00

2. When 3.75 is multiplied by 10, is the decimal point moved to the right or to the left? How many places? Does the same thing happen to the decimal point in the example 10×1.42?

3. When 3.75 is multiplied by 100, how many places to the right is the decimal point moved? Does this also happen in the example 100×1.42?

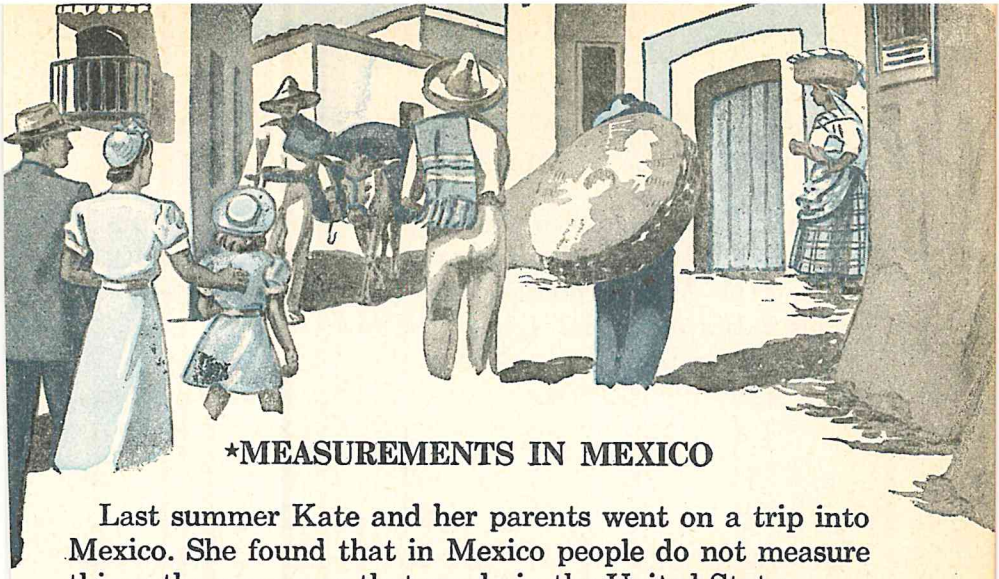
4. When 3.75 is multiplied by 1000, how many places to the right is the decimal point moved? $1000 \times 1.42 = ?$

Show that these products are correct:

	a	*b*	*c*
5.	$10 \times 1.84 = 18.4$	$100 \times .37 = 37$	$1000 \times .107 = 107$
6.	$10 \times 27.6 = 276$	$100 \times 1.7 = 170$	$1000 \times 3.6 = 3600$
7.	$10 \times 1.976 = 19.76$	$100 \times .072 = 7.2$	$1000 \times .67 = 670$

To multiply a number by 10, move the decimal point in the number one place to the right; to multiply by 100, move the decimal point two places to the right; to multiply by 1000, move the decimal point three places to the right. Annex zeros as needed to fill empty places.

8. Multiply each of these numbers by 10:
   2.7 1.85 2.768 75 3.07 .976 .05
9. Multiply each of these numbers by 100:
   45 4.5 .45 .045 1.76 1.987 27.8
10. Multiply each of these numbers by 1000:
    6.1 3.72 .875 4.96 .6 87.4 .072



*MEASUREMENTS IN MEXICO

Last summer Kate and her parents went on a trip into Mexico. She found that in Mexico people do not measure things the same way that we do in the United States.

1. Gasoline is sold by the liter. A gallon of gasoline is equal to 3.785 liters. If gasoline sold at 8 cents a liter, how much was the price a gallon, or 3.785 liters?

2. Distances traveled are measured there by kilometers. A mile is 1.609 kilometers. A sign at the side of the road showed that it was 100 miles to Mexico City. How many kilometers was the distance to Mexico City?

3. A kilometer is equal to 1000 meters. Our yard is equal to 0.914 meter. How many meters are there in 100 yards?

4. How much less than 100 meters is 100 yards?

5. Many things sold by the pound in this country are sold by the kilogram in Mexico. A pound is 0.454 kilogram. How many kilograms in a 100-pound sack of sugar?

6. How much more than 4 pounds are 4 kilograms?

7. The system of measurement used in Mexico is called the metric system. What units in the metric system compare with our yard, mile, pound, and gallon?

*8. Make drawings to show the relation of: a gallon to a liter; a yard to a meter; a mile to a kilometer.

DIAGNOSTIC TEST IN MULTIPLICATION OF DECIMALS

Work these examples carefully. If you make errors in multiplying, correct them at once. If you find difficulty in placing the decimal points correctly, turn for help to the pages indicated at the right of the row.

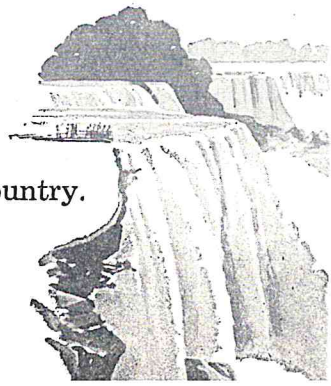
	a	*b*	*c*	*d*	*e*	*f*	
1.	3.4 ×2	2.3 ×3	6.6 ×4	5.9 ×7	7.5 ×8	9.4 ×5	(244)
2.	.1 ×4	.3 ×2	.7 ×5	.9 ×7	.5 ×4	.6 ×5	(245)
3.	.32 ×3	24 ×2	.47 ×2	3.18 ×4	5.16 ×5	7.15 ×4	(245)
4.	.656 ×7	.944 ×9	.787 ×5	2.956 ×6	8.799 ×7	58.678 ×9	(246)
5.	.06 ×4	.02 ×3	.004 ×2	.012 ×8	.006 ×6	.072 ×9	(246)

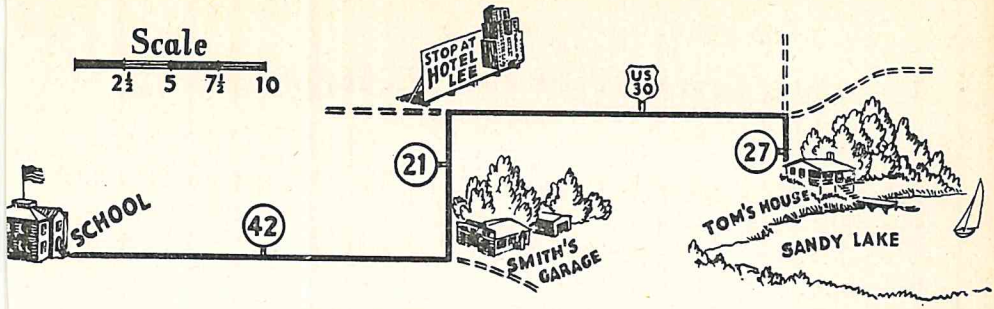
6. Multiply by 10: .6, 7.6, 8.54, 9.768. (248)
7. Multiply by 100: 2.7, 6.85, 9.874, .04. (248)
8. Multiply by 1000: 3.86, .7, .974, 3.625. (248)

*INTERESTING FACTS TO FIND OUT

If you do not need to practice multiplication of decimals, you may prepare a report on one of these topics.

1. The money used in foreign countries.
2. The history of money.
3. The value of stamp collections.
4. The size of Niagara Falls.
5. What our coins are made of.
6. Where our gold is kept.
7. The growth of aviation in our country.





DRAWING TO SCALE

Tom made this road map to show his friend, Paul, how to drive to Tom's summer home in the country. Each inch on a line on the map stands for 10 miles. This means that the map is drawn to the scale of 1 inch = 10 miles. Here is how Paul found the distances from the school to Tom's home.

1. With his ruler he measured the distance on the map from the school to Smith's garage. How many inches was this?

2. Then he measured the distance from Smith's garage to US 30; then along US 30 from 21 to 27 then from US 30 to Tom's home. Find each of these distances on the map in inches.

3. Then he found the total distance in inches on the map from the school to Tom's home. Find this total. If you have measured correctly, it should be $4\frac{3}{4}$ inches.

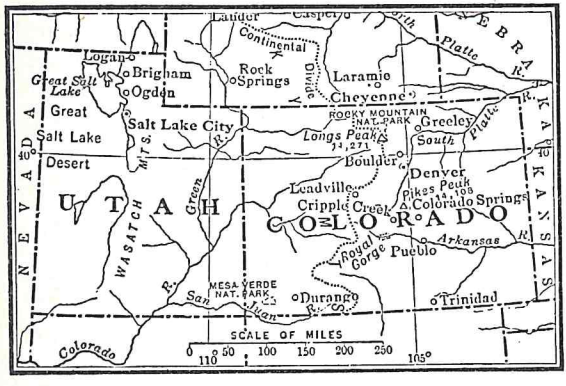
4. Next he multiplied $4\frac{3}{4}$ by 10, the number of miles one inch on the map represents. How far was it from the school to Tom's home?

5. How far is it from the school to Smith's garage?

*6. Secure a local road map and, if possible, find the scale to which it is drawn.

*7. Find out how U.S. highways that run east and west are numbered. Why are these roads called "U.S." highways?

A MAP DRAWN TO SCALE



In geography books the scale to which a map is drawn is usually shown at the foot of the map. Let us look at the map given here to learn how to use the scale to find the approximate area of the state of Colorado. We say approximate because it is very difficult to find the exact dimensions, using the scale.

1. Can we say that Colorado is shaped like a rectangle? Where is the scale given?

2. Take a stiff card about 4 inches long. Place a small dot on the edge $\frac{1}{2}$ inch from the lower left-hand corner. Mark it 0. Then place the lower edge of the card directly above the scale, so that the two 0 marks fall together. Now place marks on the edge of the card for each of the marks on the scale. Label each mark. Then move the card to the left so that the 0 mark on the scale falls in the 250-mile mark on the card. Now mark distances on the card showing 300, 350, 400, 450, and 500 miles. Label each mark neatly.

3. To find the length of Colorado, place the edge of your card on the lower border of the state so that the 0 mark falls on the west border of the state. Then read the scale to find the length of the state. Estimate the distance as accurately as you can.

4. In the same way find the width of Colorado.

5. Using your measurements, find the area of Colorado.

MULTIPLYING A DECIMAL BY A DECIMAL

1. An automobile averaged 12.5 miles on a gallon of gasoline. How far could it go on 4.5 gallons of gasoline?

$$\begin{array}{r} 12.5 \\ \times 4.5 \\ \hline 625 \\ 5000 \\ \hline 56.25 \end{array}$$

THINK: 4.5×12.5 mi. $= ?$

First multiply as with whole numbers. This gives 5625. To find where to put the decimal point in the answer, you can estimate the answer by multiplying the 12 of 12.5 by the 4 of 4.5. The product of 4×12 is 48. Since the answer should be a little more than 48, put the decimal point after the 56 in the product. This gives 56.25. The automobile can go 56.25 miles on 4.5 gallons of gasoline.

2. Use the method of estimating explained above to place the decimal points in these products:

a.	*b.*	*c.*	*d.*	*e.*
$\begin{array}{r} 2.7 \\ \times 5.8 \end{array}$	$\begin{array}{r} 4.6 \\ \times 7.1 \end{array}$	$\begin{array}{r} 8.75 \\ \times 2.3 \end{array}$	$\begin{array}{r} 9.23 \\ \times 8.4 \end{array}$	$\begin{array}{r} 7.48 \\ \times 6.9 \end{array}$

3. If the average speed of an airplane is 2.25 miles a minute, how far can it go in 4.5 minutes?

4. A fast train averages 47.2 miles an hour. How far can the train go in 4.6 hours?

5. You can use multiplication of fractions to check answers in the multiplication of decimals.

THINK: $2.3 \times 4.1 = ?$ Find the product.
$2\frac{3}{10} \times 4\frac{1}{10} = ?$ Find the product.
Are the two products the same?

6. Multiply $2\frac{7}{10}$ by $3\frac{3}{10}$. Check the answer by multiplying by decimals.

7. Multiply 2.4 by 3.5. Check the answer by multiplying with fractions.

8. How much is $.5 \times 6.4$?

MULTIPLYING DECIMALS BY DECIMALS

1. Jack has learned a method of finding the position of a decimal point in a product without estimating the answer. Study the method he uses that is described below.

$$\begin{array}{r} 2.6 \\ \times 3.4 \\ \hline 104 \\ 780 \\ \hline 8.84 \end{array}$$

First he multiplies. Then he says, "There is 1 decimal place in 2.6 and 1 decimal place in 3.4. This makes 2 decimal places in 2.6 and 3.4 together. So I point off 2 decimal places in 884, beginning at the right. This gives 8.84 as the answer." Check this answer by estimating as you did on page 253.

After multiplying decimals, point off as many decimal places in the product, counting from the right, as there are decimal places in the two numbers together that you are multiplying.

2. Apply this rule to the following examples:

a. 5.7 (1 place) $\times .5$ (1 place) 2.85 (2 places)	*b.* \$4.36 (2 places) $\times 4$ (0 places) \$17.44 (2 places)	*c.* 2.75 (2 places) $\times 1.7$ (1 place) 4.675 (3 places)
d. 3.29 (2 places) $\times .6$ (1 place) 1.974 (3 places)	*e.* 83.7 (1 place) $\times .04$ (2 places) 3.348 (3 places)	*f.* 372 (0 places) $\times .26$ (2 places) 96.72 (2 places)

3. Multiply 3.75 by 2.7 using this rule. Check your product by estimating as on page 253. Which method do you prefer?

4. Show by using the rule that the products below are correct:

a. 3.7 $\times 6$ 22.2	*b.* 7.86 $\times .9$ 7.074	*c.* 97.3 $\times 6$ 583.8	*d.* 1.25 $\times 5$ 6.25
e. 84 $\times 2.5$ 210.0	*f.* 7.5 $\times .08$ .600	*g.* 9.06 $\times 4.3$ 38.958	*h.* 9.4 $\times 7.9$ 74.26

USING THE RULE FOR MULTIPLYING DECIMALS

The products below are correct except that the decimal points have not been placed in them. Copy each example and put the decimal point in the product.

	a	*b*	*c*	*d*	*e*
1.	5.2 × 9 = 468	4.1 × .3 = 123	2.8 × 4 = 112	4.7 × 5 = 235	63 × .4 = 252
2.	9.25 × .2 = 1850	34.6 × .02 = 692	9.62 × .5 = 4810	.795 × 4 = 3180	49.7 × .08 = 3976
3.	48.9 × 9 = 4401	83.5 × .05 = 4175	376 × .09 = 3384	78.1 × .20 = 15620	3.76 × .6 = 2256
4.	30.5 × 7.8 = 23790	54.8 × .16 = 8768	2.56 × 10 = 2560	28.6 × 8.7 = 24882	7.29 × 6.1 = 44469

5. Copy the examples without the answers. Then find the products. Place the decimal points correctly.

PRACTICE IN MULTIPLYING DECIMALS

1. Find the cost of 3.4 gallons of gasoline at $.20 a gallon.

Find the products:

	a	*b*	*c*	*d*	*e*	*f*
2.	6.2 × 3.6	4.3 × 72	.76 × 5.9	27 × .48	.48 × 2.1	78 × .09
3.	82.4 × 9.5	53.9 × .84	4.08 × 6.3	496 × .08	5.68 × 27	49.7 × .7
4.	58.7 × .06	79.5 × 3.6	53.9 × 5.9	9.27 × 7.2	46.8 × .48	496 × .05

SOME OTHER DECIMALS

1. Find the area of a farm .75 mile long and .25 mile wide.

$$\begin{array}{r} .75 \\ \times .25 \\ \hline 375 \\ 1500 \\ \hline .1875 \end{array}$$

THINK: Area = .75 mi. × .25 mi. = ?
How many decimal places must be pointed off in the product?
The decimal .1875 has four places.
The area is .1875 square mile.
Can you read this four-place decimal?

In the decimal system each place has $\frac{1}{10}$ of the value of the place to the left of it.

2. The decimal .1 is $\frac{1}{10}$ of 1. The decimal .01 is $\frac{1}{10}$ of $\frac{1}{10}$, or $\frac{1}{100}$, which is written .01. The decimal .001 is $\frac{1}{10}$ of $\frac{1}{100}$, or $\frac{1}{1000}$, which is written .001. How much is $\frac{1}{10}$ of $\frac{1}{1000}$?

THINK: $\frac{1}{10}$ of $\frac{1}{1000} = \frac{1}{10} \times \frac{1}{1000} = \frac{1}{10.000}$, or 1 ten thousandth.

$\frac{1}{10.000}$ is written .0001, using the next place to the right of thousandths.

Since the decimal is given the name of the place of the last figure in it, we can say that .1875 is equal to 1 thousand 875 ten thousandths, because the 5 is in the **ten thousandths' place.**

3. Read these decimals: .9602; 5.0794; 8.0091.

4. Show that $\frac{1}{10}$ of $\frac{1}{10.000}$ is $\frac{1}{100.000}$. Read these fractions. To express this number in decimal form, we use the place next to ten thousandths' place and write this number as .00001. It is read **one hundred thousandth.**

5. Show by multiplying the numbers as fractions that 1 tenth of 1 hundred thousandth is **one millionth.** We can write one millionth in decimal form as follows: .000001.

6. Read these decimals: .000006; .00025; .018794; 1.2568; 97.654821.

7. Write as decimals: 3 millionths; 35 ten thousandths.

8. Tell the value of each figure in this number: 79.4361.

OUR AMERICAN NEIGHBORS

Ann is studying about our neighbors in North and South America. The table below gives the populations and areas of some of the important countries in the western hemisphere.

COUNTRY	POPULATION	AREA (sq. miles)
Argentina	13,129,723	1,078,278
Brazil	44,115,825	3,275,510
Colombia	8,701,816	448,794
Canada	11,012,734	3,694,863
United States (1940)	131,669,275	3,026,789

1. Which of these five countries has the largest population? the largest area?

2. Which of the South American countries has an area nearest in size to the United States? How much greater is it than the United States?

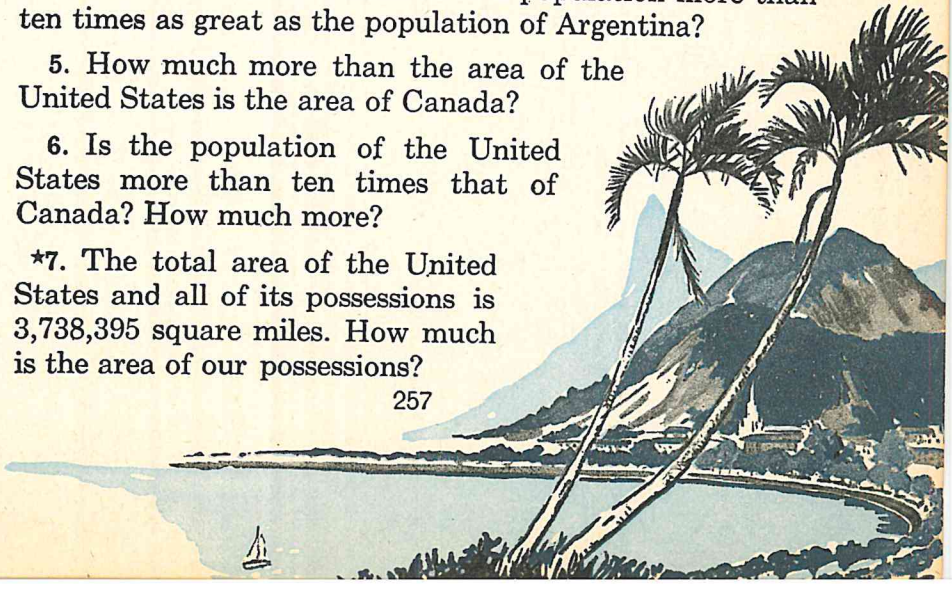
3. Is the population of Brazil more or less than a third of that of the United States?

4. Does the United States have a population more than ten times as great as the population of Argentina?

5. How much more than the area of the United States is the area of Canada?

6. Is the population of the United States more than ten times that of Canada? How much more?

*7. The total area of the United States and all of its possessions is 3,738,395 square miles. How much is the area of our possessions?



A STEP TO WATCH IN MULTIPLYING DECIMALS

1. What is the product of .3 and .3?

.3 (1 decimal place)
.3 (1 decimal place)
.09 (2 decimal places)

Since there is one decimal place in each number being multiplied, there must be two decimal places in the product. To get two places write a 0 as a place holder before the 9, and place the decimal point before the 0.

You can prove that .09 is correct by multiplying the fractions $\frac{3}{10}$ and $\frac{3}{10}$. $.3 \times .3 = \frac{3}{10} \times \frac{3}{10} = \frac{9}{100} = .09$.

2. Find the product of $.4 \times .02$.

.02 (2 places)
.4 (1 place)
.008 (3 places)

To get 3 decimal places in the answer, write 2 zeros before the 8.

$.02 \times .4 = \frac{2}{100} \times \frac{4}{10} = \frac{8}{1000} = .008$

To get the correct number of decimal places write zeros as place holders before the product.

3. Show that decimal points in the products below are correctly placed. Show by multiplying with fractions that the products are correct.

a.	*b.*	*c.*	*d.*	*e.*	*f.*
.3	.13	.07	.25	.16	.003
.3	.4	.5	.4	.08	2
.09	.052	.035	.100	.0128	.006

Multiply:

	a	*b*	*c*	*d*	*e*	*f*
4.	.2	.4	.03	.005	.12	.002
	.2	.2	.4	.3	.4	3
5.	3.7	.39	.12	4.65	65.8	.008
	.2	9	.8	.4	.79	14
6.	1.87	.011	427	.95	.18	9.74
	6.8	1.1	.09	.08	.05	57

PRACTICE IN MULTIPLICATION OF DECIMALS

Practice the examples in each set until you can work all of them correctly. Watch the decimal points.

Set I

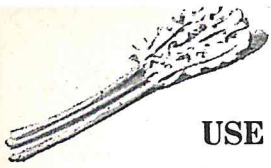
	a	*b*	*c*
1.	$2 \times .3 =$	$7 \times .1 =$	$3 \times .2 =$
2.	$4 \times .02 =$	$5 \times .01 =$	$7 \times .08 =$
3.	$6 \times .001 =$	$4 \times .001 =$	$6 \times .006 =$
4.	$6 \times .5 =$	$5 \times .04 =$	$4 \times .005 =$
5.	$8 \times 4.6 =$	$6 \times 2.4 =$	$4 \times 6.5 =$
6.	$3 \times 7.95 =$	$9 \times 7.84 =$	$6 \times 2.841 =$
7.	$.6 \times 24 =$	$.7 \times 60 =$	$.8 \times 742 =$
8.	$8 \times .375 =$	$6 \times .205 =$	$.7 \times 285 =$

Set II

1.	$.4 \times .2 =$	$.2 \times .3 =$	$.6 \times .9 =$
2.	$.4 \times .01 =$	$.3 \times .02 =$	$.7 \times .08 =$
3.	$2.6 \times .75 =$	$4.8 \times .25 =$	$7.5 \times .62 =$
4.	$.4 \times 3.64 =$	$.5 \times 9.18 =$	$.6 \times 7.24 =$
5.	$7.2 \times 2.4 =$	$8.3 \times 7.2 =$	$6.4 \times 6.5 =$
6.	$2.7 \times 5.63 =$	$1.7 \times 2.64 =$	$3.2 \times 9.28 =$
7.	$.58 \times 11.9 =$	$.73 \times 82.4 =$	$.23 \times 1.49 =$
8.	$.5 \times .032 =$	$.6 \times .012 =$	$.8 \times .043 =$

Set III

1.	$.3 \times .04 =$	$.6 \times .001 =$	$.7 \times .028 =$
2.	$1.6 \times .25 =$	$1.2 \times .3 =$	$.04 \times 1.6 =$
3.	$.07 \times 48 =$	$5 \times 1.2 =$	$7.5 \times 4.3 =$
4.	$.91 \times 68.7 =$	$9.4 \times 1.06 =$	$1.8 \times 4.95 =$
5.	$.7 \times 14 =$	$64 \times 4.8 =$	$3.7 \times 8.63 =$
6.	$10 \times 1.7 =$	$100 \times 3.54 =$	$1000 \times 8.065 =$
7.	$10 \times 3.25 =$	$100 \times 86.4 =$	$1000 \times 75.65 =$



USE OF DECIMALS IN EVERYDAY LIFE

1. Rhubarb is .95 water. Bananas are .75 water. How much more water is there in rhubarb than in bananas?

2. Strawberries are .90 water. Oranges are .87 water. How much less water is there in oranges than in strawberries?

3. Which of these four fruits is over .9 water?

4. Figs contain .16 sugar. Lemons contain .02 sugar. How much more sugar do figs contain than lemons contain?

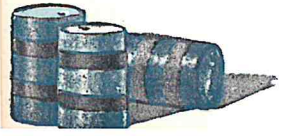
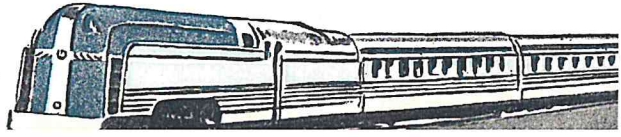
5. According to a government report, the hottest place in the world is in Tripoli, where the temperature has reached 136.4° above zero. In Siberia we find the coldest place in the world, where the temperature has reached 90.4° below zero. Find the difference in the temperature in these two places.

6. To hatch turkey eggs they are put into incubators with a temperature of 99.5°. In one hatchery the temperature dropped 11 degrees and only 2 out of 100 of the eggs hatched. How low did the temperature fall? How many hundredths of the eggs hatched? How many hundredths did not hatch?

7. In 1923 there were born 22.2 babies for each 1000 people in this country. In a later year only 16.7 babies were born for each 1000 people. How many fewer babies were born that year for each 1000 people than in 1923?

8. In 1900 the world produced only 149.1 million barrels of petroleum. In a recent year the world produced 2,036.0 million barrels. How many more barrels were produced that year than in 1900?

9. Several years ago the cost of riding a mile by rail was 3.6 cents. In a recent year the cost averaged 1.9 cents a mile. Find the difference in the costs for these two years.

ARE YOU READY FOR THE DIAGNOSTIC TEST?

1. How many decimal places should be pointed off in the product of the numbers 4.8×6.75?

2. Give the rule for pointing off decimal places in the product.

3. Does annexing zeros to the right of a decimal change the value of the decimal? For example, does $.75 = .7500$?

4. Show how zeros are used to find the product of $.5 \times .01$. When do you write the zeros? Why?

5. How can you use multiplication of fractions to check the product of $.4 \times .7$?

6. Arrange these numbers in the order of their value from largest to smallest:

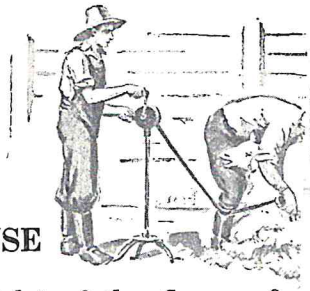
37.0 3.70 370 .370 .037

7. Is the number of decimal places in a product of two decimals ever less than the number of decimal places in either of the numbers being multiplied?

DIAGNOSTIC TEST IN MULTIPLICATION OF DECIMALS BY DECIMALS

Use this test to find any points about multiplying with decimals on which you may need more practice. If you make more than one mistake in a row of examples, turn for help to the pages given at the right.

	a	*b*	*c*	
1.	$.4 \times 2.5 =$	$.6 \times 2.75 =$	$.8 \times 4.976 =$	(254)
2.	$2.3 \times 1.4 =$	$1.8 \times 2.64 =$	$3.4 \times 25.2 =$	(254)
3.	$.06 \times 2.5 =$	$1.08 \times 46.2 =$	$3.05 \times 7.83 =$	(256)
4.	$.2 \times .3 =$	$.4 \times .02 =$	$.5 \times .007 =$	(258)
5.	$.16 \times 1.87 =$	$.79 \times .86 =$	$.08 \times 4.57 =$	(258)



THE WOOL WE USE

1. The average weight of the fleece of a sheep is 7.9 pounds. Find the weight of the fleeces of a flock of 3800 sheep.

2. Fleeces of sheep are usually cut by clipping machines. A man can clip the wool of about 100 sheep a day. Find the weight of the wool he can clip a day.

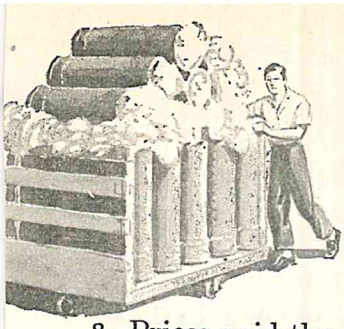
3. The weight of the fleece of a sheep is not the same in all parts of the country. For example, in Georgia the average weight of a fleece is 3.5 pounds. In Montana the average weight is 9.4 pounds. How much less than the average weight for Montana is the average weight of a fleece in Georgia? How can you account for the difference in the weight of fleeces in Montana and Georgia?

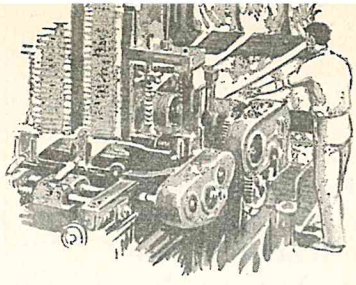
4. How much more than two times as much as a Georgia fleece does the average Montana fleece weigh?

5. About .6 of the weight of a Montana fleece is grease and dirt. This must be scoured (cleaned) before the wool can be made into thread. What part of the weight of the fleece is the scoured wool? How much scoured wool is there in a Montana fleece weighing 9.40 pounds?

6. In Georgia about .4 of the weight of a fleece is grease and dirt. How much scoured wool is there in a Georgia fleece weighing 3.5 pounds?

7. Some kinds of sheep have much heavier fleeces than others. Merino rams sometimes have fleeces weighing 35 pounds. Cheviot sheep have fleeces weighing about 6 pounds. How many times as much as this is the weight of the fleece of a Merino ram?





8. Prices paid the farmer for wool change from year to year. For example, in 1928 the price of grease wool was 38.7 cents a pound, while in 1932 the price was only 7.0 cents a pound. Find the difference in the price a pound in those two years. Try to find the present price. Why do prices of wool vary so much?

9. A farmer had a flock of 96 sheep. The wool they produced weighed 912 pounds. Find the average weight of the wool a sheep.

10. How much would the farmer receive for the wool at $.23 a pound?

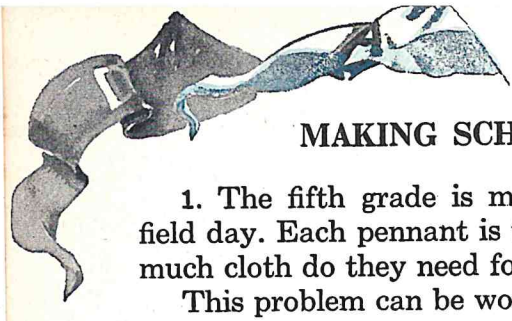
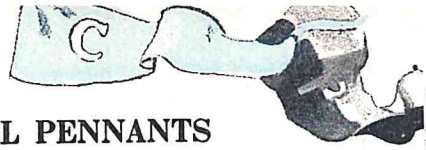
11. The wool of Merino sheep is very fine and is about $2\frac{1}{4}$ inches long. The wool of the Cotswold sheep is about $13\frac{1}{2}$ inches long. How much longer than Merino wool is Cotswold wool? How many times as long is it?

12. In a recent year Texas had 61,450,000 sheep. The average weight of the fleeces was 8.2 pounds. How much wool did Texas produce?

13. In a recent year the United States consumed 383.8 million pounds of cleaned wool. Of this amount 278.3 million pounds were used for clothing. How much of the wool was used for other purposes?

14. In another year the United States produced 468.1 million pounds of wool and imported 257.7 million pounds of wool. How much wool in all was produced or imported by the United States that year?

*15. What is wool used for?

MAKING SCHOOL PENNANTS

1. The fifth grade is making school pennants for the field day. Each pennant is to be 2 feet 4 inches long. How much cloth do they need for 10 pennants?

This problem can be worked in two ways.

I. 2 ft. 4 in.
×10
20 ft. 40 in. = 23 ft. 4 in.

Multiply 4 in. by 10. This gives 40 in.
Multiply 2 ft. by 10. This gives 20 ft.
40 in. = 3 ft. 4 in. So 20 ft. 40 in. = 23 ft. 4 in.

II. 2 ft. 4 in. = $2\frac{4}{12}$ or $2\frac{1}{3}$ ft.
$10 \times 2\frac{1}{3} = 23\frac{1}{3}$ ft.

Change 2 ft. 4 in. to feet. Then multiply $2\frac{1}{3}$ by 10. Do the two answers have the same value?

2. Use both methods to find the answers to these examples:

a. 3 ft. 6 in. ×7 _____

b. 4 hr. 20 min. ×8 _____

c. 7 lb. 14 oz. ×9 _____

Which method do you prefer?

3. If 3 feet 8 inches of cloth are needed for a pennant, how much cloth is needed for 45 pennants?

4. Use either method to find the total weight of 24 cans of corn if each can weighs 1 pound 4 ounces.

Find the products, using the more convenient method:

5. 2 min. 10 sec. ×6 _____

6. 3 qt. 1 pt. ×7 _____

7. 5 hr. 30 min. ×4 _____

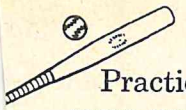
8. 8 ft. $4\frac{1}{2}$ in. ×2 _____

9. 2 lb. $3\frac{1}{4}$ oz. ×7 _____

10. 6 yd. $2\frac{3}{4}$ ft. ×8 _____

11. Find the distance around a square flower bed that is 8 feet 6 inches on each side.

12. Find the distance around a flower bed shaped like a triangle if each side is 9 feet 8 inches long.



LET'S PRACTICE

Practice one of these sets of examples a day. If you need more practice, work the same set of examples on several days. Keep a record of your scores to see how your work improves.

Set I

1. $\begin{array}{r} 9.87 \\ 12.95 \\ .75 \\ 534.42 \\ 7.66 \\ 16.97 \\ \hline \end{array}$

2. $\begin{array}{r} 600.32 \\ -599.45 \\ \hline \end{array}$

3. $\begin{array}{r} 29.5 \\ \times 16 \\ \hline \end{array}$

4. $\begin{array}{r} 7\frac{3}{4} \\ +8\frac{1}{2} \\ \hline \end{array}$

5. $\begin{array}{r} 8\frac{3}{4} \\ -2\frac{5}{8} \\ \hline \end{array}$

6. $\begin{array}{r} 3\frac{1}{2} \\ \times 8 \\ \hline \end{array}$

7. $54\overline{)3828}$

8. $9 \div \frac{4}{5} =$

9. $\begin{array}{r} 6 \text{ ft. } 7 \text{ in.} \\ +9 \text{ ft. } 8 \text{ in.} \\ \hline \end{array}$

10. $46\overline{)27738}$

Set II

1. $\begin{array}{r} 957.6 \\ 28.4 \\ 9283.6 \\ 885.3 \\ 39.9 \\ 348.6 \\ \hline \end{array}$

2. $\begin{array}{r} 91.065 \\ -37.087 \\ \hline \end{array}$

3. $\begin{array}{r} 37.8 \\ \times 45.9 \\ \hline \end{array}$

4. $\begin{array}{r} 9\frac{7}{10} \\ +8\frac{7}{10} \\ \hline \end{array}$

5. $\begin{array}{r} 15\frac{1}{4} \\ -9\frac{1}{2} \\ \hline \end{array}$

6. $\frac{4}{5} \times 3\frac{1}{3} =$

7. $65\overline{)2547}$

8. $6\frac{2}{3} \div 10 =$

9. $\begin{array}{r} 6 \text{ qt. } 1 \text{ pt.} \\ \times 5 \\ \hline \end{array}$

10. $14\overline{)7196}$

USING THE VOCABULARY OF ARITHMETIC

Write sentences showing how we use these words in arithmetic. Be ready to read them to the class.

census	producing	invert	dot map	diagonal
fare	kilowatt	exact	sea level	nearest inch
total	reasonable	discount	graph	recipe
square mile	annex	oil gauge	kilometer	barometer

HOW WELL DO YOU REMEMBER?

1. What is the difference between common fractions and decimal fractions?

2. How can you use multiplication of common fractions to check multiplication of decimal fractions?

3. How can you tell the number of decimal places to point off in the product of two decimals?

4. Which is most, .3, .27, or .275? How can you tell?

5. How do you add 3.7 and 5.96?

6. What is wrong with the examples below?

a. $3\frac{1}{2} \div 1\frac{1}{3} = \frac{7}{2} \times \frac{4}{3} = \frac{28}{6} = 4\frac{2}{3}$

b.
$$\begin{array}{r} 2.76 \\ \times .5 \\ \hline 13.80 \end{array}$$

c. $\frac{4}{5} \times 2\frac{1}{2} = \frac{4}{5} \times \frac{5}{2} = \frac{20}{10}$

7. How do you add the fractions $\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{4}$?

8. How do you find the whole of a number if you know that half of it equals 3.7?

9. Express to the nearest cent: 6.25¢; 7.75¢; $3\frac{5}{8}$¢.

INFORMATION PLEASE!

1. How are people paid for the work they do?

2. Why are all workers not paid the same wages?

3. Why do prices of food and farm products vary from year to year?

4. In what parts of our country is the density of population greatest?

5. Why do many people prefer the use of decimals to the use of common fractions?

6. Make a list of at least ten uses of decimals that you have studied in this book.

7. Show that our system of measuring weight is not a decimal system.

MEASURING GROWTH IN PROBLEM SOLVING

1. John weighs $95\frac{1}{2}$ pounds. Paul weighs $87\frac{3}{4}$ pounds. How much more does John weigh than Paul?

2. It is 117.8 miles from the city to the lake and 2.3 miles farther to the summer cottage. How far is it from the city to the cottage?

3. How much do $1\frac{3}{4}$ pounds of meat cost at \$.28 a pound?

4. If an automobile can go a mile in $1\frac{1}{5}$ minutes, how far can it go in one hour?

5. At 25 cents a quarter yard, how much does one yard of lace cost?

6. Oranges are on sale at 3 for 10 cents. How much does a dozen oranges cost at this rate?

7. At a track meet Jack jumped 10 feet 6 inches. Tom jumped 8 feet $9\frac{1}{2}$ inches. How much farther than Tom jumped did Jack jump?

8. The average fare for airplane travel is about \$.057 a mile. At this rate how much does it cost to travel a distance of 200 miles by airplane?

9. A gallon of water weighs about 8.34 pounds. A gallon of milk weighs about 8.52 pounds. How much more than 10 gallons of water weigh do 10 gallons of milk weigh?

10. On a test of 25 words Mary spelled 5 of the words incorrectly. What part of the words did she spell correctly?

What Your Score Means

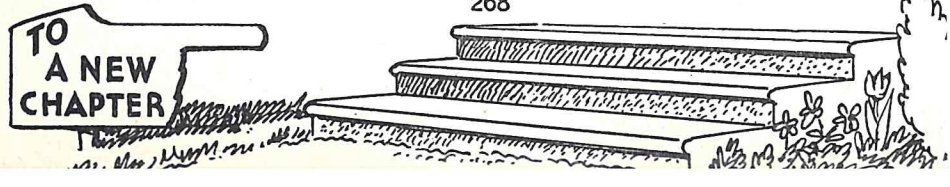
Unsatisfactory	Fair	Good	Excellent
0 1 2 3 4	5 6	7 8	9 10

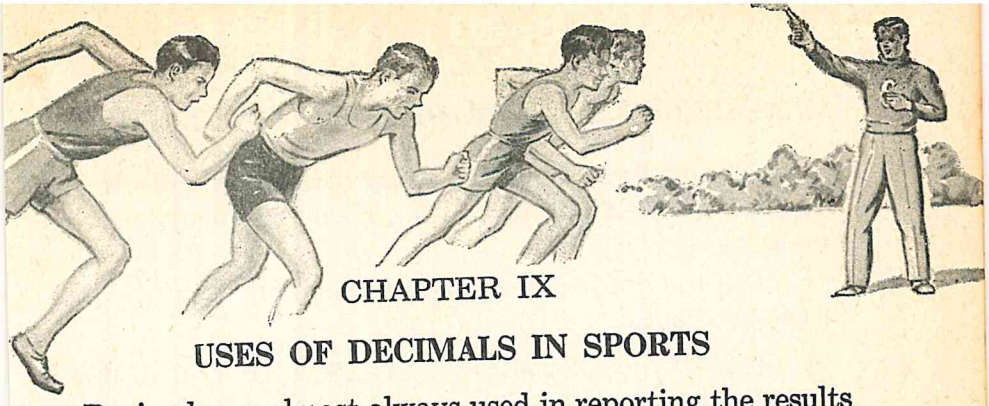
UP THE STEPS TO A NEW CHAPTER

This test will help you to find out how well you know the arithmetic you have studied. When you copy the numbers be sure to leave enough space for your work.

1. Add: $4\frac{1}{2} + 6\frac{3}{4} + 8\frac{7}{8} + 3\frac{7}{10} = ?$ (124)
2. Subtract $5\frac{5}{6}$ from $9\frac{3}{4}$. (147)
3. Multiply \$12.50 by 470. (59)
4. Divide 4086 by 48. Check your answer. (77)
5. Add: 3 lb. 8 oz., 5 lb. 4 oz., and 6 lb. 3 oz. (156)
6. Subtract 3 ft. 6 in. from 10 ft. 4 in. (156)
7. How much do 8 cans of peas weigh if 1 can weighs 1 lb. 3 oz.? (264)
8. What part of a pound is 14 ounces? (264)
9. If $\frac{2}{3}$ pound of tea costs 60 cents, how much does 1 pound cost? (229)
10. Add: $28.567 + 1.783 + .005 + 376.043 = ?$ (42)
11. Subtract 6.75 from 13.25. Check by addition. (49)
12. How much is $\frac{1}{2}$ of $\frac{3}{4}$? (177)
13. Multiply $4\frac{2}{3}$ by $3\frac{3}{5}$. (185)
14. How much is $6\frac{3}{4} \times 80$? (170)
15. How many half inches are there in $9\frac{1}{2}$ inches? (211)
16. How much is $2\frac{2}{3}$ divided by $1\frac{1}{6}$? (211)
17. Divide $6\frac{2}{3}$ by 5. Check by multiplication. (220)
18. How much is $8 \times .375$? (245)
19. Multiply 3.6 by 8.4. (253)
20. How much is 10×1.7? 100×23.5? (248)

After your paper has been marked, correct your answers at once. If necessary, turn for help to the pages given at the right of the test. Be sure that you know how to work every example in the test before you go on to the next chapter.





CHAPTER IX

USES OF DECIMALS IN SPORTS

Decimals are almost always used in reporting the results of races in track meets.

1. The 50-yard dash record for elementary schools is 6.8 seconds. This time is sometimes written as 0:06.8. Write in this form 9.4 seconds, the world record for the 100-yard dash.

2. The newspaper reported that Cunningham once ran a mile in 4:04.4. What do you think this means?

3. If a boy could keep running for 100 yards at the rate given for the 50-yard dash in problem 1, how long would it take him to run 100 yards? How much longer would this be than the time given in problem 1 for the world record for the 100-yard dash? THINK: 100 yd. = ? times 50 yd.

4. Keith swam 20 yards, the length of a swimming pool, in 16.4 seconds. At that rate how long would it take him to swim 100 yards?

5. In a recent year the world record for the 440-yard ($\frac{1}{4}$ mile) dash was 46.4 seconds. The record for the 220-yard dash was 20.3 seconds. If a man could run 440 yards at the record rate for 220 yards, how much less time than the record would it take him to run 440 yards? What part of a mile is 220 yards?

*6. If a runner could run a mile at the record rate for 440 yards, how much less time would it take him to run the mile than the record set by Cunningham? (See problem 2.)

READINESS TEST FOR DIVISION OF DECIMALS

You are about to begin the study of division of decimals. This test will help you to find out if you are ready for this new work.

I. Find the quotients. Express remainders with fractions in the quotients.

1. $59\overline{)2690}$ 2. $84\overline{)80472}$ 3. $25\overline{)6890}$ 4. $42\overline{)3381}$

II. Divide. Be sure to place the decimal points in the quotients.

1 $8\overline{)\$9.60}$ 2. $5\overline{)\$1.25}$ 3. $6\overline{)\$.36}$ 4. $5\overline{)\$3}$ 5. $4\overline{)\$9}$

III. Dividing by cents.

1 Express as cents: \$1.28; \$2.56; \$.70; \$.05.

2. How many times is \$.04 contained in the following amounts of money?

\$.64; \$2.40; \$8.16; \$4; \$5.40

3. How many notebooks at \$.25 each can you buy for \$2.25?

IV. Multiplying by 10 and 100.

1. How much is 10×1.1? 10×2.46? 10×3.984?
2. How much is 100×2.4? 10×3.47? 100×39.658?
3. How can you change $\frac{3}{10}$ to $\frac{30}{100}$? $\frac{3}{10}$ to $\frac{300}{1000}$?
4. Does $4\frac{7}{10}$ equal $4\frac{70}{100}$? Why?
5. Change to hundredths: $7\frac{1}{10}$; $\frac{5}{10}$; 3.

V. Dividing tenths and hundredths.

1. Divide $3\frac{3}{10}$ by $\frac{3}{10}$.
2. Divide $5\frac{1}{10}$ by $1\frac{7}{10}$.
3. Divide $6\frac{2}{10}$ by 2. Express the answer as a decimal.
4. Divide 5 by $1\frac{25}{100}$.
5. Express the decimals as fractions and then divide:

a. $2.7 \div 3 =$ *b.* $8 \div 2.4 =$ *c.* $.6 \div .2 =$

d. $5.4 \div .4 =$ *e.* $7.5 \div 5 =$ *f.* $1.8 \div 3.6 =$

HOW MUCH WORKERS EARN

Our government has made studies to find how much workers are paid for their labor. The figures below are for four industries for a recent year.

Work	Wages an Hour	Hours a Week	Wages a Week
Machine Shops	73.6¢	40.6 hr.	(?)
Lumber Industry	53.6¢	43.4 hr.	(?)
Printing	95.2¢	38.8 hr.	(?)
Cotton (men)	45.8¢	37.3 hr.	(?)

1. How much did workers in machine shops receive as wages an hour? How many hours a week did they work?

2. Give to the nearest cent the wages an hour of each of the workers. THINK: Is 73.6¢ nearer 73¢ or 74¢? How can you tell?

3. How much did the machine shop workers earn a week?

THINK: 40.6 × 73.6¢ = ?
Change 73.6¢ to $.736.
Then multiply.
Is the product correct?

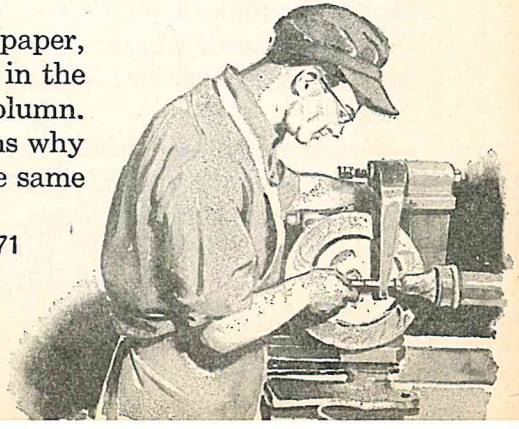
$$\begin{array}{r} \$.736 \\ \times 40.6 \\ \hline 4416 \\ 294400 \\ \hline \$29.8816 \end{array}$$

We say that the worker received $29.88, to the nearest cent, because $.881 is nearer $.88 than $.89. If the product had been $29.8876, the wages would be $29.89, because $.887 is nearer $.89 than $.88.

4. Give to the nearest cent: $.8860, $2.9134, $3.9568, $23.1904.

5. On a separate piece of paper, copy the chart above and fill in the correct amounts in the last column.

*6. Can you give any reasons why these workers are not paid the same wages an hour?



HOW PEOPLE ARE PAID FOR THE WORK THEY DO

1. Mr. Jones is paid \$.67$\frac{1}{2}$ cents an hour at the shoe factory. He works $5\frac{1}{2}$ days a week, 8 hours each day. How much does he earn a week?

2. Mr. Jackson is a clerk in a grocery store. He is paid \$29.70 a week. On the average he works 9 hours a day and 6 days a week. How much does he earn an hour?

3. Tom, the owner of the newsstand at the corner, sells newspapers. He pays $3\frac{1}{2}$ cents for each paper and sells it for 5 cents. How many papers must he sell before he earns \$4.50?

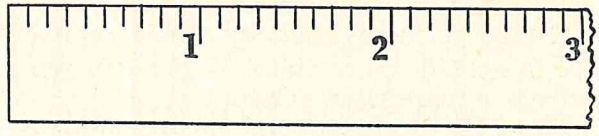
4. Miss Shay, a clerk in a women's clothing store, is paid \$10 a week and $\frac{1}{10}$ of all of the money received for the goods she sells. If she sells clothing valued at \$250 in one week, how much does she earn in all that week?

5. Workers in garment factories are often paid by the piece. Makers of one part of a dress are paid 90 cents a dozen for making that part. A fast worker makes 45 dozen a week. A slow worker makes only 30 dozen a week. How much more does the fast worker earn a week than the slow worker?

*6. Can you tell other ways in which workers are paid for the work they do? Discuss the good points and bad points of the different ways.

USING A RULER IN DIVIDING DECIMALS

You can learn much about dividing decimals by using a ruler in which the inches are divided into tenths.



1. Draw a line .6 inch long. Divide it into two equal parts. How long is each part?

2. To find the answer by division we do the work as follows:

THINK: .6 in. $\div$ 2 = $2\overline{).6}$ = 3 tenths in., or .3 in.

3. Use the ruler to find how long each of three equal parts of a line .6 inch long would be. Then check by division.

THINK: .6 in. $\div$ 3 = ?

Use the piece of ruler above to find the answers to the following examples. Then check by division.

	a	*b*	*c*	*d*
4.	.8 $\div$ 2 =	1.2 $\div$ 3 =	2.4 $\div$ 4 =	1.0 $\div$ 5 =
5.	.8 $\div$ 4 =	1.2 $\div$ 4 =	2.5 $\div$ 5 =	2.0 $\div$ 4 =
6.	.9 $\div$ 3 =	1.2 $\div$ 6 =	2.4 $\div$ 2 =	3.0 $\div$ 6 =

You can see that in these examples you divided tenths by whole numbers and there were tenths in the answers. In dividing with decimals you must be sure to place the decimal point in the quotient.

You can also check your work in division of decimals by using division of fractions. For example, you know that .9 $\div$ 3 = .3. Show that $\frac{9}{10} \div 3 = \frac{3}{10}$.

7. Use division of fractions to show that 2.7 $\div$ 3 equals .9. Use the ruler also to show that 2.7 in. $\div$ 3 equals .9 inch.

DIVIDING DECIMALS BY WHOLE NUMBERS

1. A mail train traveled 7.2 miles in 6 minutes. How many miles did it average a minute?

$$\begin{array}{r} 1.2 \\ 6\overline{)7.2} \\ 6 \\ \hline 12 \\ 12 \\ \hline \end{array}$$

THINK: $7.2 \div 6 = ?$

Divide as in dividing by whole numbers. Since $6\overline{)7}$ is a little more than 1, you can see that 1.2 miles is a reasonable answer.

Place the decimal point in the quotient directly above the decimal point in the number being divided.

The train averaged 1.2 mi. a minute.

To check the answer, multiply 1.2 mi. by 6.

2. If you divide a line .6 in. long into 2 equal parts, how long will each part be?

THE FRACTION WAY

$\frac{6}{10} \div 2 = \frac{6}{10} \times \frac{1}{2} = \frac{3}{10}$ in.

THE DECIMAL WAY

$$\begin{array}{r} .3 \\ 2\overline{).6} \\ 6 \\ \hline \end{array}$$

3. Study the work below and use the methods explained in 1 and 2 above to show that the decimal points in the quotients are placed correctly.

6.9	.3	6.5	.5	5.4
a. $7\overline{)48.3}$	*b.* $4\overline{)1.2}$	*c.* $5\overline{)32.5}$	*d.* $6\overline{)3.0}$	*e.* $8\overline{)43.2}$
42	12	30	30	40
63		25		32
63		25		32

Divide and check:

	a	*b*	*c*	*d*	*e*
4.	$5\overline{)8.5}$	$5\overline{)1.0}$	$7\overline{)44.8}$	$8\overline{)642.4}$	$9\overline{)74.7}$
5.	$25\overline{)87.5}$	$5\overline{)2.5}$	$15\overline{)22.5}$	$32\overline{)220.8}$	$64\overline{)307.2}$
6.	$4\overline{)75.2}$	$3\overline{).9}$	$54\overline{)437.4}$	$65\overline{)331.5}$	$12\overline{)75.6}$

DIVIDING LARGER DECIMALS

1. During a hard rainstorm 3.76 inches of rain fell in 2 hours. How much was that on the average an hour?

$$\begin{array}{r} 1.88 \\ 2\overline{)3.76} \\ 2 \\ \hline 17 \\ 16 \\ \hline 16 \\ 16 \\ \hline \end{array}$$

THINK: 3.76 in. ÷ 2 = ?

You can see that 1.88 is a reasonable answer; since $2\overline{)3}$ is a little more than 1. Place the decimal point in the quotient directly above the decimal point in 3.76.

1.88 in. of rain fell in an hour.

2. You can check the answer by multiplying 1.88 by 2. Check the answer.

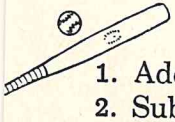
3. Study the work below and check the answers by the methods explained in 1 and 2 above.

a. $4\overline{)9.76}$ = 2.44	*b.* $6\overline{)39.84}$ = 6.64	*c.* $8\overline{)89.528}$ = 11.191

4. When you are sure that you understand the work, copy the examples and work them with your book closed.

Divide. Check your answers:

	a	*b*	*c*	*d*
5.	$4\overline{)12.72}$	$5\overline{)18.75}$	$9\overline{)27.63}$	$8\overline{)9.04}$
6.	$5\overline{)8.625}$	$7\overline{)24.801}$	$6\overline{)86.454}$	$9\overline{)48.897}$
7.	$25\overline{)9.175}$	$12\overline{)1.584}$	$45\overline{)94.5}$	$64\overline{)15.36}$

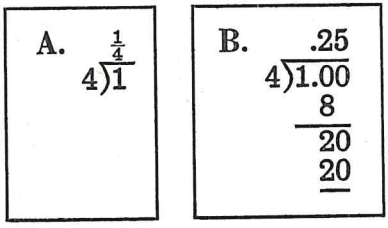


LET'S PRACTICE

1. Add $3\frac{1}{4}$ to each of these numbers: $\frac{1}{4}$; $3\frac{3}{4}$; $2\frac{1}{2}$; $3\frac{7}{8}$; $5\frac{2}{3}$.
2. Subtract $2\frac{1}{2}$ from each of these numbers: 4; $5\frac{1}{2}$; $6\frac{3}{4}$; $7\frac{1}{4}$; $6\frac{2}{3}$.
3. Multiply by $\frac{3}{4}$ each of these numbers: 6; 9; $\frac{1}{2}$; $2\frac{1}{4}$; $3\frac{1}{3}$.
4. Divide by $1\frac{1}{4}$ each of these numbers: 5; 7; $2\frac{1}{2}$; $\frac{2}{3}$; $5\frac{3}{4}$; $3\frac{5}{6}$.

CHANGING FRACTIONS TO DECIMALS

1. If 4 books weigh 1 pound, how much does 1 book weigh?



THINK: $1 \div 4 = ?$
In Box A the quotient is $\frac{1}{4}$.
$1 \div 4$ is the same as $\frac{1}{4}$.
In Box B we change 1 to 1.00 and divide.
One book weighs .25 lb.

You know that $\frac{1}{4}$ means $1 \div 4$. To change $\frac{1}{4}$ to a decimal, write 1 as 1.00 and divide by 4. $4\overline{)1.00}$ $\quad .25$

The quotient is .25. Therefore $\frac{1}{4} = .25$

2. To change $\frac{3}{4}$ to a decimal, remember that $\frac{3}{4}$ means $4\overline{)3}$. Write 3 as 3.00 and divide by 4. What is the result?

To change a common fraction to a decimal, put a decimal point after the numerator, annex zeros, and then divide by the denominator.

Change the following fractions to decimals. Annex zeros until the division comes out even. You will not need to annex more than three zeros:

	a	*b*	*c*	*d*	*e*	*f*
3.	$\frac{1}{2}$	$\frac{7}{20}$	$\frac{1}{5}$	$\frac{5}{8}$	$\frac{7}{16}$	$\frac{7}{8}$
4.	$\frac{1}{8}$	$\frac{2}{5}$	$\frac{3}{16}$	$\frac{7}{25}$	$\frac{3}{10}$	$\frac{4}{5}$
5.	$\frac{1}{10}$	$\frac{3}{8}$	$\frac{17}{20}$	$\frac{3}{5}$	$\frac{9}{20}$	$\frac{7}{10}$

6. Do the two numbers $\frac{3}{5}$ and .6 have the same value? To find out, either change $\frac{3}{5}$ to a decimal or .6 to a fraction.

Which of these pairs of numbers have the same value?

7. .125, $\frac{1}{8}$
8. $\frac{1}{4}$, .25
9. $\frac{7}{10}$, .7
10. $\frac{1}{5}$, .2
11. .4, $\frac{2}{5}$
12. $\frac{4}{25}$, .16
13. $\frac{3}{8}$, .375
14. $\frac{1}{2}$, .5

CHANGING REMAINDERS TO DECIMALS

1. Mary rode 8 miles on her bicycle in 50 minutes. How many minutes did she average a mile?

$$8\overline{)50} \quad 6\tfrac{1}{4} \qquad 48 \qquad 2$$

$$8\overline{)50.00} \quad 6.25 \qquad 48 \qquad 20 \qquad 16 \qquad 40 \qquad 40$$

THINK: 50 min. ÷ 8 = ?
In the first box there is a quotient of $6\frac{1}{4}$ when we divide 50 by 8. If we write 50 as 50.00 before dividing by 8, there is no remainder. Mary averaged a mile in 6.25 minutes. Check the answer by multiplying 6.25 by 8.

You can often avoid fractions in quotients by annexing zeros after the decimal point in the dividend and dividing.

2. Martha made 15 pounds of candy. She wanted to divide it into 4 equal parts. How many pounds could she put into each part? Express the answer first as a fraction. Then find the answer by annexing zeros and dividing as shown above.

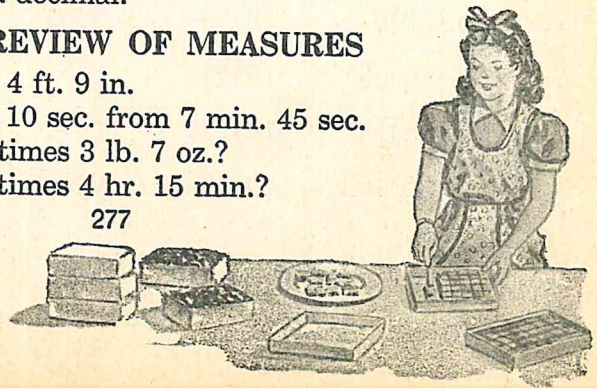
3. Mr. Smith pays $21 a year for the telephone. How much does he pay a month?

4. One year 27 inches of rain fell in Minneapolis. How much rain fell on the average a month? Express the answer as a decimal.

5. Jack found that 5 bananas weighed 21 ounces. How many ounces did the bananas weigh on the average? Express the answer as a decimal.

QUICK REVIEW OF MEASURES

1. Add: 3 ft. 7 in., 4 ft. 9 in.
2. Subtract 3 min. 10 sec. from 7 min. 45 sec.
3. How much is 4 times 3 lb. 7 oz.?
4. How much is 5 times 4 hr. 15 min.?



PRACTICE IN EXPRESSING REMAINDERS AS DECIMALS

In these examples you are to express the remainders as decimals. Put a decimal point and two 0's after the number you are dividing, then continue dividing. Check each answer.

	a	*b*	*c*	*d*	*e*
1.	$4\overline{)19}$	$4\overline{)5}$	$8\overline{)10}$	$4\overline{)13}$	$4\overline{)17}$
2.	$8\overline{)18}$	$12\overline{)15}$	$4\overline{)15}$	$8\overline{)14}$	$8\overline{)22}$
3.	$16\overline{)84}$	$4\overline{)11}$	$12\overline{)27}$	$16\overline{)44}$	$12\overline{)57}$
4.	$80\overline{)580}$	$40\overline{)170}$	$72\overline{)270}$	$64\overline{)272}$	$60\overline{)465}$

In these examples the work will come out even if you put only one 0 after the number you are dividing. Check each answer.

5.	$5\overline{)8}$	$2\overline{)11}$	$20\overline{)128}$	$8\overline{)12}$	$40\overline{)180}$
6.	$15\overline{)48}$	$8\overline{)44}$	$5\overline{)6}$	$6\overline{)9}$	$16\overline{)88}$
7.	$6\overline{)15}$	$5\overline{)9}$	$2\overline{)35}$	$12\overline{)30}$	$5\overline{)7}$

In these examples you are to write in as many zeros as are needed to make the division come out even. Check each answer. If you annex more than three zeros, something is wrong with your work.

8.	$5\overline{)26}$	$8\overline{)11}$	$75\overline{)390}$	$10\overline{)97}$	$4\overline{)97}$
9.	$20\overline{)81}$	$8\overline{)62}$	$2\overline{)81}$	$8\overline{)27}$	$6\overline{)75}$
10.	$40\overline{)65}$	$16\overline{)68}$	$8\overline{)5}$	$30\overline{)183}$	$32\overline{)136}$
11.	$8\overline{)13}$	$16\overline{)124}$	$50\overline{)75}$	$40\overline{)330}$	$20\overline{)41}$
12.	$30\overline{)168}$	$60\overline{)264}$	$50\overline{)306}$	$80\overline{)270}$	$40\overline{)82}$

WORKING WITH INCOMPLETE DECIMALS

In changing some fractions to decimals, you always have a remainder.

In changing $\frac{1}{3}$ to a decimal, if you annex one 0 when dividing, you get $\frac{1}{3} = .3\frac{1}{3}$; if you annex two 0's, you get $\frac{1}{3} = .33\frac{1}{3}$; if you annex three 0's, you get $\frac{1}{3} = .333\frac{1}{3}$. No matter to how many places you carry the work, there is always a remainder. We call the numbers $.33\frac{1}{3}$ or $.333\frac{1}{3}$, **incomplete decimals.** We usually say that $\frac{1}{3}$ equals $.33\frac{1}{3}$.

Change the fractions below to incomplete decimals. Carry the work to two decimal places:

1. $\frac{2}{3}$ $\frac{1}{9}$ $\frac{1}{6}$ $\frac{4}{15}$ $\frac{4}{9}$ $\frac{11}{12}$ 2. $\frac{5}{9}$ $\frac{3}{7}$ $\frac{3}{11}$ $\frac{5}{6}$ $\frac{5}{12}$ $\frac{7}{9}$

USING DECIMALS IN FINDING AVERAGES

1. Jack fed his dog $2\frac{3}{10}$ pounds of bones and meat one week, $2\frac{1}{10}$ pounds the next week, and $2\frac{1}{2}$ pounds the third week. How many pounds did he feed his dog on the average a week?

You can find the answer to this problem by using either fractions or decimals. Study the work below. Which method is simpler? Explain each step in the work.

WITH FRACTIONS

$$\begin{aligned} 2\tfrac{3}{10} &= 2\tfrac{3}{10} \\ 2\tfrac{1}{10} &= 2\tfrac{1}{10} \\ 2\tfrac{1}{2} &= 2\tfrac{5}{10} \\ \hline & \quad 6\tfrac{9}{10} \end{aligned}$$

$$6\tfrac{9}{10} \div 3 = \tfrac{69}{10} \times \tfrac{1}{3} =$$

$$\tfrac{69}{30} = 2\tfrac{9}{30} = 2\tfrac{3}{10}$$

WITH DECIMALS

$$\begin{aligned} 2\tfrac{3}{10} &= 2.3 \\ 2\tfrac{1}{10} &= 2.1 \\ 2\tfrac{1}{2} &= 2.5 \\ \hline & \quad 6.9 \end{aligned}$$

$$3\overline{)6.9}\quad 2.3$$

Are the two answers the same? Which method is easier?

2. Find the average of these three fractions, using decimals: *a.* $2\frac{4}{5}$, $4\frac{1}{2}$, $7\frac{7}{10}$ *b.* $2\frac{7}{10}$, $3\frac{1}{5}$, $7\frac{3}{10}$ *c.* $4\frac{1}{2}$, $2\frac{2}{5}$, $6\frac{7}{10}$.

ROUNDING OFF DECIMALS

1. In a race an automobile went 6 miles in 8.6 minutes. How many minutes was this a mile?

THINK: 8.6 min. ÷ 6 = ?

$$\begin{array}{r} 1.43 \\ 6\overline{)8.60} \\ 6 \\ \hline 26 \\ 24 \\ \hline 20 \\ 18 \\ \hline 2 \end{array}$$

In this example there is a remainder after the work has been carried to two decimal places. The answer may be **rounded off** by dropping the last figure of the quotient. Thus, the answer is 1.4 minutes, making it **correct to the nearest tenth.** The answer is 1.4 minutes instead of 1.5 minutes because 1.43 is closer to 1.4 than to 1.5. If the quotient had been 1.46, it would have become 1.5 when rounded off because 1.46 is closer to 1.5 than to 1.4.

2. In the example at the right the quotient is carried to three decimal places. The quotient becomes 1.29 when rounded off to the **nearest hundredth,** because 1.287 is closer to 1.29 than to 1.28.

$$\begin{array}{r} 1.287 \\ 7\overline{)9.010} \end{array}$$

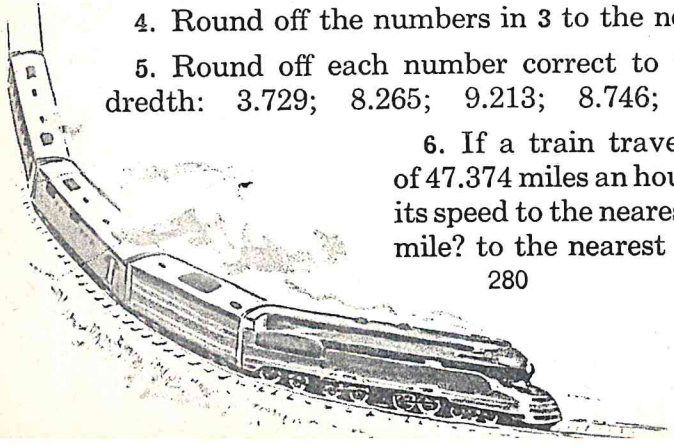
To round off (1) carry the quotient to one more place than will be kept in the result; (2) if the last figure is 5 or more, increase by one the next figure to the left; thus .46 to the nearest tenth is .5; **(3) if the last figure is less than 5, drop it;** thus .542 to the nearest hundredth is .54.

3. Round off each number correct to the nearest tenth:

7.46; 9.23; 7.45; 67.28; 95.04; 87.58

4. Round off the numbers in 3 to the nearest one.

5. Round off each number correct to the nearest hundredth: 3.729; 8.265; 9.213; 8.746; 25.675; 41.024



6. If a train traveled at the speed of 47.374 miles an hour, what would be its speed to the nearest hundredth of a mile? to the nearest tenth of a mile?

PRACTICE IN ROUNDING OFF

1. A freight train went 134 miles in 6 hours. Find the average number of miles it went an hour, to the nearest tenth of a mile.

2. A passenger train went 134 miles in 3 hours. Find its average speed an hour, to the nearest tenth of a mile.

3. Jack ran 100 yards in 12 seconds. Find the number of yards he ran a second to the nearest hundredth of a yard.

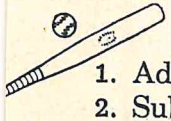
In these examples round off the results correct to the nearest tenth. Carry the work to two decimal places.

	a	*b*	*c*	*d*
4.	$27\overline{)53}$	$69\overline{)81.7}$	$49\overline{)35}$	$18\overline{)24}$
5.	$94\overline{)167}$	$57\overline{)961.5}$	$37\overline{)95}$	$16\overline{)26}$
6.	$38\overline{)111.1}$	$99\overline{)125.4}$	$48\overline{)64.8}$	$47\overline{)94.3}$

In these examples round off the results correct to the nearest hundredth. Remember that you must carry the work to three decimal places.

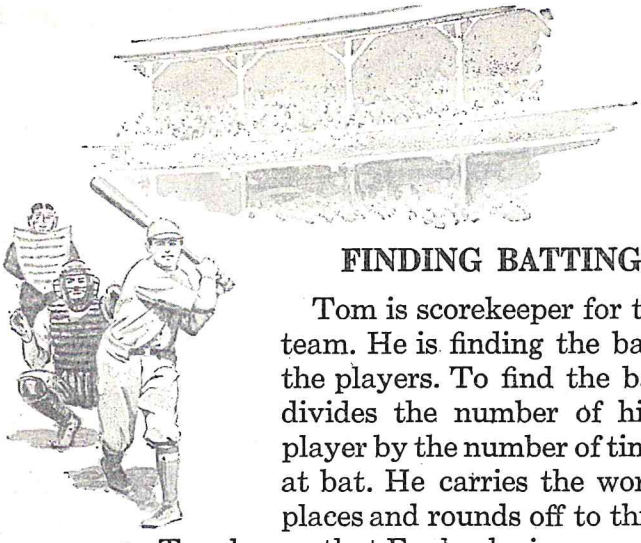
	a	*b*	*c*	*d*
7.	$18\overline{)26.14}$	$23\overline{)48.74}$	$14\overline{)100.7}$	$77\overline{)256.81}$
8.	$67\overline{)147.2}$	$68\overline{)171.52}$	$32\overline{)36.0}$	$58\overline{)372.14}$
9.	$13\overline{)102}$	$79\overline{)103.46}$	$19\overline{)84.7}$	$89\overline{)111.29}$

In this book do not carry your work to more than three decimal places unless told to do so.



LET'S PRACTICE

1. Add $3\frac{3}{4}$ to each of these numbers: $\frac{1}{4}$; $\frac{3}{4}$; $4\frac{3}{4}$; $2\frac{1}{2}$; $5\frac{7}{8}$; $6\frac{2}{3}$.
2. Subtract $2\frac{1}{4}$ from each of these numbers: 5; $6\frac{1}{4}$; $7\frac{3}{4}$; $8\frac{1}{2}$.
3. Multiply each number by $1\frac{1}{2}$: 5; 6; $\frac{1}{2}$; $1\frac{1}{2}$; $3\frac{3}{4}$; $2\frac{2}{5}$.
4. Divide each number by 4: $5\frac{1}{3}$; $\frac{1}{2}$; 6; $3\frac{1}{3}$; 3; $12\frac{1}{2}$.



FINDING BATTING AVERAGES

Tom is scorekeeper for the school baseball team. He is finding the batting averages for the players. To find the batting average, he divides the number of hits made by each player by the number of times that player was at bat. He carries the work to four decimal places and rounds off to three decimal places.

1. Tom knows that Fred, who is a very good batter, made 18 hits in 54 times at bat. What was his batting average? THINK: $18 \div 54 = ?$

2. Tom read in a record book that one year Boston had a batting average for the year of .299. This means that the team made hits at the rate of 299 for each 1000 times at bat. What does a batting average of .333 mean?

3. Ben made 15 hits in 40 times at bat. What was his batting average? Was he as good a hitter as Fred?

4. Arthur made only 12 hits in 45 times at bat. What was his average?

5. Bob made 10 hits in 50 times at bat. What was his average?

6. Which of these boys had the highest batting average? Which had the lowest batting average?

*7. Look up the batting averages of some of your favorite baseball players in the big leagues. Check some of the averages.

*8. What is meant by "fielding average"?

*9. In a recent year the New York Yankees won .667 of the 154 games played. How many games did they win?

DIAGNOSTIC TEST IN DIVISION OF DECIMALS

If you make any mistakes on the test, turn for help to the pages given at the right. Carry the division to not more than three places.

	a	*b*	*c*	
1.	$2\overline{)5.8}$	$3\overline{)7.5}$	$8\overline{)65.6}$	(274)
2.	$4\overline{)8.76}$	$5\overline{)27.15}$	$6\overline{)35.166}$	(275)
3.	$4\overline{)33}$	$5\overline{)61}$	$8\overline{)73}$	(277)
4.	$15\overline{)17.3}$	$21\overline{)28.25}$	$47\overline{)96.28}$	(280)

5. Reduce to decimals: $\frac{4}{5}$, $\frac{3}{4}$, $\frac{7}{8}$. (276)

6. Reduce to decimals, correct to the nearest hundredth: $\frac{5}{6}$, $\frac{7}{12}$, $\frac{9}{16}$. (276)

7. Round off to the nearest tenth: .29; .149; .253. (280)

8. Round off to the nearest one: 27.41; 6.8; 31.56. (280)

*REPEATING DECIMALS

Jack had a lot of fun working with what his father called **repeating decimals.** These are often found when reducing fractions to decimals. Be sure your work is correct in finding the answers to the problems below.

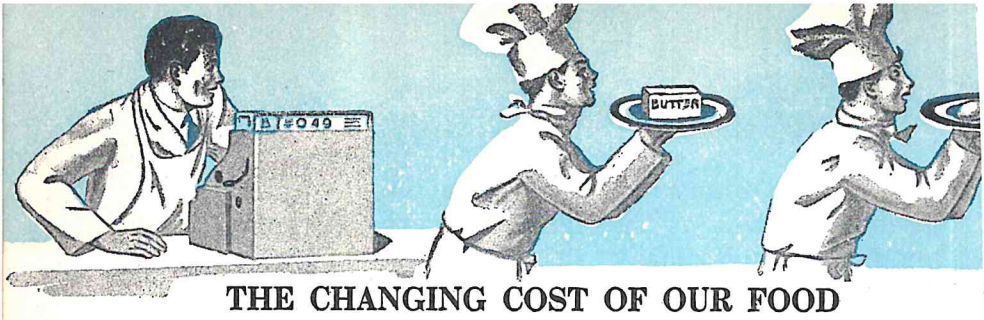
1. Change $\frac{2}{3}$ to a decimal by dividing 2 by 3. Carry your work to six decimal places. What do you find?

2. Change $\frac{5}{6}$ to a six-place decimal. What numbers repeat?

3. Change $\frac{2}{9}$ to a six-place decimal. What numbers repeat?

4. Change $\frac{2}{11}$ to a six-place decimal. What numbers repeat? Try this with $\frac{1}{11}$, $\frac{5}{11}$, and $\frac{7}{11}$.

5. Change $\frac{2}{7}$ to a twelve-place decimal. Do you find any numbers repeating? Try this with $\frac{1}{7}$ and $\frac{4}{7}$.



THE CHANGING COST OF OUR FOOD

In other years, prices of food have been less than they are today. The table shows the amounts of some of the important kinds of food each person in this country eats in a year and the prices of the foods in 1900, 1920, and a recent year.

Kind of Food	Amount a Person	Prices a Unit in Cents		
		1900	1920	A Recent Year
Flour	53 lb.	2.5	8.1	4.8
Potatoes	141 lb.	1.4	6.3	2.8
Sugar	29 lb.	6.1	19.4	5.6
Eggs	12 doz.	20.7	68.1	36.9
Butter	35 lb.	26.1	70.1	40.8

Use the table to answer these questions:

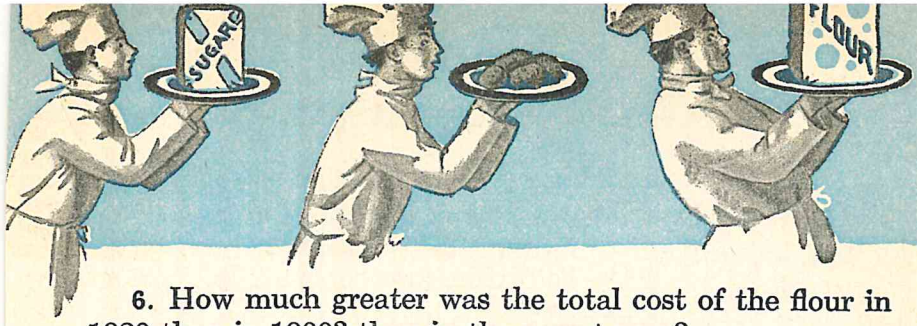
1. About what foods does the table give information?

2. How many pounds of flour does each person eat in a year?

3. What was the price of flour a pound in 1900? We can write 2.5 cents as \$.025. What was the price to the nearest cent in 1900? in 1920? in the recent year? In what year was the price the highest?

4. In what year was the price of potatoes highest? of sugar? of eggs? of butter? Try to find out why the prices of these foods were highest that year.

5. How much was the cost of the flour used by one person in 1900? in 1920? in the recent year? Give the answers correct to the nearest cent.



6. How much greater was the total cost of the flour in 1920 than in 1900? than in the recent year?

7. How much higher was the price of eggs in 1920 than in 1900? the price of sugar? of butter?

8. How much less than in 1920 was the price of eggs in the recent year? of sugar? of butter?

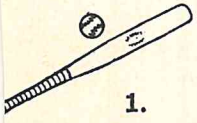
9. Would it be correct to say that the prices of these foods in 1920 were about three times as high as in 1900? Prove your answer.

10. Find the cost of the potatoes used by one person for each of the three years.

*11. Find local prices of each of these foods today. Are they higher or lower than the prices given in the table?

*12. Using local prices, find the cost of each of these kinds of food for one person for one year. Then find the total cost of all of the foods listed in the table.

LET'S PRACTICE



30

	a	*b*	*c*	*d*	*e*
1.	$6\frac{3}{4}$ $+5\frac{7}{8}$	4.27 $\times 506$	$9\frac{1}{2}$ $-4\frac{3}{4}$	$3\frac{1}{2} \times 5 =$	$47\frac{1}{4}$ $\times 6$
2.	8.76 $+2.91$	$\frac{1}{2} \times \frac{1}{4} =$	$\frac{3}{4} \div \frac{1}{4} =$	8.75 $\times 2.7$	27.84 -9.95

3. $2\frac{1}{2} \div 7\frac{1}{2} =$ $9\overline{)8.748}$ $3\frac{1}{2} \div 7 =$ $78\overline{)335.4}$ $1\frac{1}{2} \times 3\frac{1}{3} =$

4. Add: $3.78 + 15.96 + 129.43 + .08 = ?$

DIVIDING WITH MEASURES

1. A bottle containing 2 pounds 8 ounces of honey costs 25 cents. How much is the cost of the honey a pound?

2 lb. 8 oz. $= 2\frac{8}{16}$ or $2\frac{1}{2}$ pounds.
$25 \div 2\frac{1}{2} =$
$25 \times \frac{2}{5} = \frac{50}{5} = 10$

THINK: 25¢ ÷ 2 lb. 8 oz. = ?
To divide, first change 2 lb. 8 oz. to pounds.
Then divide 25 by $2\frac{1}{2}$.
The cost a pound is 10 cents.

2. A bottle containing 3 pounds 4 ounces of honey costs 26 cents. How much does the honey cost a pound?

3. A roast that weighed 4 pounds 10 ounces cost $1.48. How much was the cost a pound?

4. Use this method to find the cost of one yard of cloth if a piece 4 yards 2 feet long cost $1.40.

5. Find the number of minutes it took a car to go a mile if it made 10 miles in 24 minutes 30 seconds.

THINK: 24 min. 30 sec. ÷ 10 = ?
Change the time to minutes. Then divide.

6. Six large cans of fruit weighed in all 20 pounds 10 ounces. Find the weight of one can.

7. Three hens weighed in all 12 pounds 6 ounces. Find their average weight. Do you need to reduce their total weight to pounds in this problem? Explain.

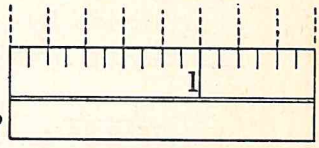
8. Joe wishes to cut a board 9 feet 6 inches long into four equal pieces. How long should each piece be?

Divide:

9. 10 lb. 5 oz. by 5.
10. 7 qt. 1 pt. by 4.
11. 9 hr. 8 min. by 6.
12. 5 yd. 2 ft. by 3.
13. 8 ft. 4 in. by 2.
14. 15 min. 25 sec. by 5.
15. 10 ft. ÷ 2 ft. 6 in. = (?)
16. 12 gal. ÷ 1 gal. 2 qt. = (?)
17. 15 hr. ÷ 2 hr. 15 min. = (?)
18. 25 yd. ÷ 3 yd. 1 ft. = (?)
*19. 7 lb. 8 oz. ÷ 1 lb. 4 oz. = (?)
*20. 4 ft. 6 in. ÷ 2 ft. 3 in. = (?)

DIVIDING A DECIMAL BY A DECIMAL

This piece of ruler is 1.6 inches long. You can use it to find the answers to some examples in which you divide a decimal by a decimal.



1. It is divided into pieces .2 inches long. How many pieces each .2 inch long are there? $1.6 \div .2 = ?$

2. You can work the example without a ruler like this:

You can express $1.6 \div .2$ as the fraction $\frac{1.6}{.2}$. The denominator is a decimal. You can **change the denominator, .2, to a whole number, 2, by multiplying it by 10. If you multiply the denominator by 10, you must also multiply the numerator by 10,** otherwise the value of the fraction is changed.

$$\frac{1.6}{.2} = \frac{10 \times 1.6}{10 \times .2} = \frac{16}{2} = 8$$

Is the answer in 2 the same as the answer you found in 1 above? Show that $1\frac{6}{10} \div \frac{2}{10} = 8$.

3. Use the ruler to find how many .8 inch lengths there are in 1.6 inches. $1.6 \div .8 = ?$ Does $1\frac{6}{10} \div \frac{8}{10}$ equal 2?

4. Explain each step in the work below:

$$\frac{1.6}{.8} = \frac{10 \times 1.6}{10 \times .8} = \frac{16}{8} = 2$$

5. Show that the work below is correct:

$$1.6\overline{)2.4} = \frac{2.4}{1.6} = \frac{10 \times 2.4}{10 \times 1.6} = \frac{24}{16} = 16\overline{)24.0} \qquad 1.5$$

You can divide any decimal by a decimal if both the divisor and the dividend are multiplied by a number which will make the divisor a whole number.

Divide the following, using the method described above.

	a	*b*	*c*	*d*	*e*
6.	$.5\overline{)4.5}$	$.7\overline{)2.8}$	$.6\overline{).36}$	$.4\overline{)3.2}$	$1.5\overline{).45}$
7.	$.9\overline{)8.1}$	$1.8\overline{)14.4}$	$.3\overline{)72}$	$1.2\overline{)3.48}$	$2.5\overline{)6.75}$

DIVIDING BY LARGER DECIMALS

1. An airplane flew 3.75 miles in .75 minute. How many miles was that a minute? 3.75 mi. $\div$ .75 = ?

To divide by .75 you must first change .75 to 75 by multiplying .75 by 100. Explain the work below:

$$.75\overline{)3.75} = \frac{3.75}{.75} = \frac{100 \times 3.75}{100 \times .75} = \frac{375}{75} = 75\overline{)\begin{array}{r}5\\375\\\hline 375\end{array}}$$

The airplane goes 5 miles a minute.

Check: .75 $\times$ 5 = 3.75.

2. An automobile went 36.675 miles in .75 hour. How many miles an hour was this? 36.675 mi. $\div$ .75 = ?

$.75\overline{)36.675} = \frac{36.675}{75} =$

$\frac{100 \times 36.675}{100 \times .75} = \frac{3667.5}{75}$

$\frac{3667.5}{75} = 75\overset{?}{)}3667.5$

How do we get the $\frac{36.675}{.75}$?

Why do we multiply both terms by 100?

Why can we write $\frac{3667.5}{75}$ as a division example?

Find the quotient.

Use the method shown to work the examples below.

	a	*b*	*c*	*d*
3.	$.12\overline{)1.56}$	$.11\overline{)1.76}$	$.15\overline{)2.25}$	$.11\overline{)1.837}$
4.	$.05\overline{).275}$	$.08\overline{)2.616}$	$.32\overline{)6.72}$	$.75\overline{).525}$

5. Explain the steps in the work below.

$$.25\overline{)7.5} = \frac{7.5}{.25} = \frac{100 \times 7.5}{100 \times .25} = \frac{750}{25} = 25\overline{)\begin{array}{r}30\\750\end{array}}$$

Find the quotients:

	a	*b*	*c*	*d*
6.	$.12\overline{)7.2}$	$.25\overline{)7.5}$	$.84\overline{)201.6}$	$.76\overline{)4.408}$
7.	$.78\overline{)33.54}$	$.57\overline{)364.8}$	$.43\overline{)3.397}$	$.64\overline{)371.2}$

DIVIDING A WHOLE NUMBER BY A DECIMAL

1. Look at the ruler on page 273. How many lengths .2 inch each are there in 1 inch? $1 \div .2 = ?$

Here you are dividing a whole number by a decimal.

2. This example can also be worked as shown below:

$$.2\overline{)1} = \frac{1}{.2} = \frac{10 \times 1}{10 \times .2} = \frac{10}{2} = 2\overline{)10}$$

$$5$$

Is this answer the same as the answer in problem 1? Show that $1 \div \frac{2}{10} = 5$.

3. Explain the work below for solving the example $75 \div 2.5$:

$$2.5\overline{)75} = \frac{75}{2.5} = \frac{10 \times 75}{10 \times 2.5} = \frac{750}{25} = 25\overline{)750}$$

$$30$$

Does $75 \div 2\frac{5}{10} = 30$? Does $30 \times 2.5 = 75$?

4. Supply the missing numbers in the following:

$$a.\ .24\overline{)144} = \frac{144}{.24} = \frac{? \times 144}{100 \times .24} = \frac{?}{24} = 24\overline{)?}$$

$$?$$

$$b.\ .75\overline{)12} = \frac{12}{.75} = \frac{? \times 12}{? \times .75} = \frac{?}{?} = ?\overline{)?}$$

Check the answers in *a* and *b* by multiplying the quotients and divisors. How is dividing a whole number by a decimal like dividing a decimal by a decimal?

Divide, using the method explained above:

	a	*b*	*c*	*d*
5.	$.4\overline{)8}$	$.3\overline{)9}$	$.15\overline{)6}$	$.8\overline{)10}$
6.	$1.2\overline{)6}$	$2.5\overline{)75}$	$.48\overline{)144}$	$.75\overline{)375}$

MIXED PRACTICE IN DIVIDING DECIMALS

1.	$.5\overline{)75}$	$1.2\overline{)1.44}$	$1.1\overline{).121}$	$.75\overline{)67.5}$
2.	$3.2\overline{)259.2}$	$.41\overline{)135.3}$	$6\overline{)9.78}$	$5.2\overline{)65}$
3.	$.33\overline{)759}$	$4\overline{)9.372}$	$.43\overline{)473}$	$.92\overline{)1.932}$

DIVIDING ANY NUMBER BY A DECIMAL

You can divide any number by any decimal just as you have divided by tenths and hundredths.

1. How many small pieces of butter each weighing .025 pound can be cut from a piece weighing 1.375 pounds?

$1.375 \div .025 = ?$

$.025\overline{)1.375} = \frac{1.375}{.025} = \frac{1000 \times 1.375}{1000 \times .025} = \frac{?}{?}$

Why do we multiply by 1000?
Complete the example.

2. How many times is .025 contained in 2?
THINK: $2 \div .025 = ?$

$.025\overline{)2} = \frac{2}{.025} = \frac{? \times 2}{? \times .025} = \frac{?}{?}$

Divide:

	a	*b*	*c*	*d*
3.	$.008\overline{)1.6}$	$.004\overline{).368}$	$.015\overline{)2.25}$	$.048\overline{)1.536}$
4.	$.091\overline{)182}$	$.006\overline{)15}$	$.012\overline{).144}$	$.072\overline{)3.7152}$

CHECKING DIVISION BY MULTIPLICATION

You can check division of decimals by multiplying the quotient and the divisor just as you check division of whole numbers.

Divide. Then check your work by multiplying:

	a	*b*	*c*	*d*
1.	$.3\overline{)2.76}$	$.5\overline{)39.5}$	$.8\overline{)27.28}$	$.7\overline{)29.197}$
2.	$1.5\overline{)6.75}$	$.25\overline{).125}$	$4.8\overline{)4.08}$	$3.2\overline{)40.96}$
3.	$.025\overline{).375}$	$.009\overline{)6.759}$	$.045\overline{).135}$	$.08\overline{)12}$
4.	$9.6\overline{)710.4}$	$.06\overline{)1.5}$	$.04\overline{)1.8}$	$.74\overline{)72.96}$

PLACING THE DECIMAL POINT IN THE QUOTIENT

Mary's father taught her a rule that he learned to use to check the placing of the decimal point in the quotient.

1. He explained the method to her like this:

$$\begin{array}{r} 2.7 \\ 2.5\overline{)6.75} \\ \underline{5\,0} \\ 1\,75 \\ \underline{1\,75} \end{array}$$

There is one decimal place in 2.7. There is one decimal place in 2.5. Together there are two decimal places in 2.7 and 2.5. There are two decimal places in 6.75. So the decimal point in the quotient is placed correctly.

He said, "The quotient and the divisor together should have as many decimal places in them as there are in the dividend, or number divided."

2. Use this rule to find if these quotients are correct:

a. $1.2\overline{)14.4}$ $\quad$ *b* $.06\overline{).174}$ $\quad$ *c.* $2.5\overline{)9.75}$ $\quad$ *d.* $7.2\overline{)1800}$

3. Show that the rule Mary's father used is another way of telling how many decimal places there should be in the product, when you check a division example by multiplying the quotient by the divisor.

MULTIPLYING DECIMALS BY 10, 100, AND 1000

1. How much do 10 apples weigh if 1 apple weighs 2.4 ounces? 2.75 ounces? 2.698 ounces?

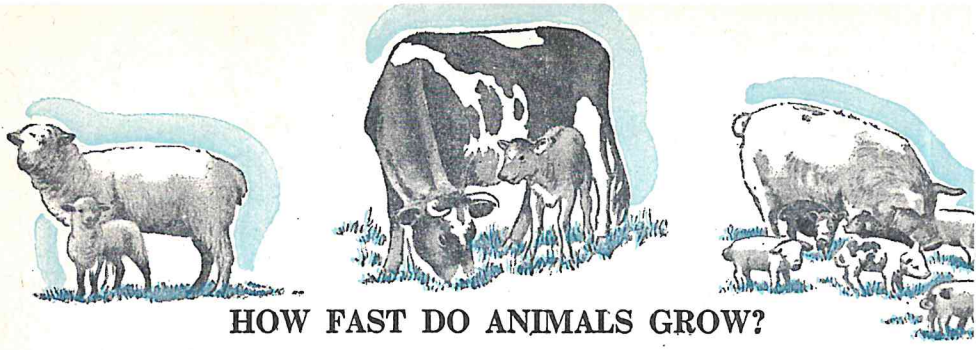
2. How much do 100 eggs weigh if 1 egg weighs 1.8 ounces? 1.75 ounces? 1.875 ounces?

3. By what number must you multiply 2.6 to get a product of 26? of 260?

4. What is the product of 1000×2.6? 1000×4.75?

5. Tell the number by which you must multiply the first number to get the second number below:

a. .25 to get 25. *b.* 2.14 to get 214. *c.* .081 to get 81.
d. 1.4 to get 14. *e.* 3.16 to get 316. *f.* .175 to get 175.



HOW FAST DO ANIMALS GROW?

1. Jersey calves weigh on the average 55.8 pounds when born. At the end of two months they weigh on the average 105 pounds. How much do they gain on the average in a month?

2. How much less than double their weight at birth is their weight at the end of two months?

3. At the end of 24 months Jersey cows weigh 716 pounds. How much does their weight increase from birth until they are this old?

4. Holstein calves weigh 90 pounds when born. At the end of 2 years they weigh 840 pounds. How many times as much as their weight at birth is their weight at the end of two years?

5. Shorthorn cattle, used mostly for beef, gain on the average 2.14 pounds a day when they are one-year-olds and 1.88 pounds a day when they are two-year-olds. How much more a day do they gain when they are one-year-olds than when they are two-year-olds?

6. How many pounds does a one-year-old Shorthorn gain before it becomes two years old? Count 365 days as a year.

7. Three-year-old Shorthorns weigh 2,363 pounds. Two-year-old Shorthorns weigh 1,901 pounds. How much is the difference in these weights?

8. The lambs of Shropshire sheep weigh 9.51 pounds at birth. They double their weight in 15 days. How much do they weigh then?

9. Little pigs weigh about 2.15 pounds at birth. They double their weight in about 9 days. How much do they weigh then?

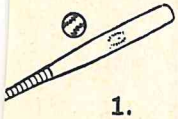
10. Young pigs gain on the average 0.81 pounds a day until they weigh 100 pounds. Then they gain 1.70 pounds a day until they weigh 200 pounds. Then they gain 1.83 pounds a day until they weigh 300 pounds. How much less do they gain a day when they weigh less than 100 pounds than they gain when they weigh between 100 and 200 pounds? When they weigh between 200 and 300 pounds? Pigs grow more slowly after they weigh 300 pounds.

11. If a young pig weighs 100 pounds today, how much should it weigh in 30 days if its growth is normal?

12. If a healthy young pig weighs 200 pounds today, how much should it weigh in 30 days if its growth is normal?

13. Babies double their weight in about 180 days. If babies weigh about 7.06 pounds at birth, how much do they weigh at the end of 180 days?

*14. Which of these doubles its weight at birth most quickly, babies, cows, pigs, or sheep? Which takes the longest time to double its weight?



LET'S PRACTICE

	a	*b*	*c*	*d*	*e*
1.	$8\frac{1}{4}$ $+7\frac{1}{2}$	36 $-15\frac{1}{4}$	784 $\times 306$	$5\frac{3}{4}$ $+6\frac{7}{8}$	9.08 $\times 9.5$
2.	$8\overline{)19.288}$	8 ft. 4 in. $-$2 ft. 6 in.	$8\frac{1}{4}$ $-7\frac{3}{4}$	$2.5\overline{)12.375}$	$9 \div 1\frac{1}{2} =$
3.	$2\frac{1}{2} \times \frac{4}{5} =$	$\frac{1}{2} \div \frac{1}{4} =$	320 $\times 6\frac{1}{2}$	$6\frac{2}{3} \div 4 =$	$9\frac{1}{4}$ $-5\frac{1}{2}$

4. $98.7 + 6.4 + 297.5 + .8 = ?$

A SHORT CUT IN DIVISION BY DECIMALS

You can save much work and time in dividing by a decimal if you use the short method described below. You do much of the work mentally.

1. Suppose that you want to divide 37.68 by 1.2.

A. $1.2\overline{)37.68}$

B. $1.2_{\wedge}\overline{)\quad}$

C. $1.2_{\wedge}\overline{)37.6_{\wedge}8}$

D. $1.2_{\wedge}\overline{)37.6_{\wedge}8}$

THINK: To change 1.2 to a whole number, I multiply it by 10. This moves the decimal point one place to the right. Put a mark ($_{\wedge}$) after the 2 to show the new position of the decimal point. (See Box B) Since I multiplied 1.2 by 10, I must also multiply 37.68 by 10. This moves the decimal point one place to the right. Put a ($_{\wedge}$) after the 6 in 37.68 as shown in Box C. The decimal point in the quotient will be above the $_{\wedge}$ in 37.68. Tell why. (Study again page 287 if you need to.)

2. Now you can divide, because by shifting the decimal point the example has been changed to $12\overline{)376.8}$. But you have not had to do all of the work with fractions such as you did on earlier pages.

These are the steps in the short method using the $_{\wedge}$:

a. Move the decimal point in the divisor as many places to the right as are necessary to change the divisor to a whole number. (See B)

b. Move the decimal point in the dividend the same number of places to the right. (See C)

c. Place the decimal point in the quotient directly above the new decimal point in the dividend and then divide as in dividing by a whole number. (See D)

3. Explain the shifting of the decimal points in the examples below and find the quotients:

a. $2.2_{\wedge}\overline{)6.8_{\wedge}2}$ *b.* $.12_{\wedge}\overline{)1.44_{\wedge}}$ *c.* $.04_{\wedge}\overline{).16_{\wedge}8}$

4. Divide 3.125 by 2.5, using the method shown above.

PRACTICE IN DIVIDING BY A DECIMAL

1. Before you begin to practice dividing by a decimal study the example at the left carefully.

$$
\begin{array}{r}
16.1 \\
1.1_{\wedge}\overline{)17.7_{\wedge}1} \\
\underline{11} \\
67 \\
\underline{66} \\
11 \\
\underline{11} \\
\end{array}
$$

How many places is the decimal point in 1.1 to be shifted? By what number must both 1.1 and 17.71 be multiplied? What does the ($\wedge$) after 1.1 show? What does the ($\wedge$) between the 7 and 1 show? Where will the decimal point be in the quotient? How can you check the answer by multiplying?

2. Copy these examples and locate the decimal points in the quotients as explained on page 294.

a. $2.4\overline{)9.84}$ $\quad$ *b.* $3.6\overline{).792}$ $\quad$ *c.* $.41\overline{)1.353}$

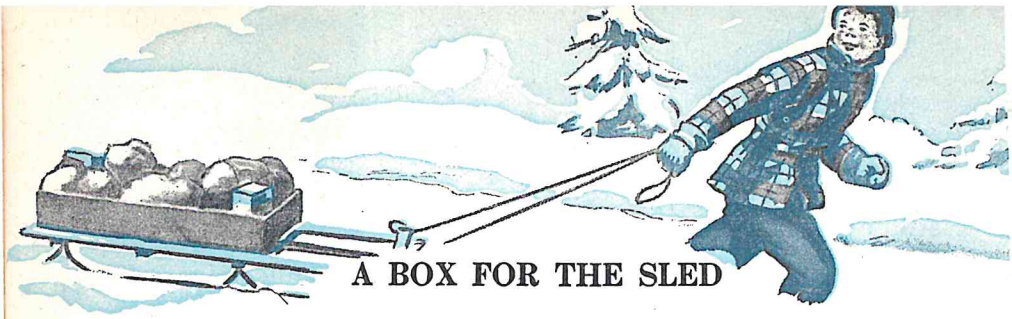
3. Now copy and work the three examples in 2. Check your answers by multiplication.

Divide and check your work:

	a	*b*	*c*	*d*
4.	$.5\overline{)7.5}$	$.04\overline{)1.776}$	$.003\overline{)1.596}$	$1.2\overline{)1.44}$
5.	$5.3\overline{)21.73}$	$.43\overline{)6.665}$	$3.1\overline{)19.22}$	$9.2\overline{)1.932}$
6.	$.64\overline{)6.208}$	$7.5\overline{)44.25}$	$2.4\overline{)194.4}$	$.088\overline{)36.696}$

7. Study the work at the left used to solve the example 37.5 divided by .25:

$$
\begin{array}{r}
\quad\quad\quad



A BOX FOR THE SLED

1. Allen is building a box for his sled so he can haul groceries home from the market this winter. He needs 4 boards. Two of the boards must be 3 feet 8 inches long to make the sides. Each of the other 2 boards must be 18 inches long to make the ends. How many feet of board in all does Allen need?

2. He plans to make the box 6 inches high. How many square feet of board will he use? (HINT: Think of 6 inches as $\frac{1}{2}$ foot.)

3. He has one 6-inch board that is 7 feet long. Can he get two boards for the long way of the box from this 7-foot board? Can he use this board for the 2 short boards?

4. How much will be wasted if he uses this 7-foot board for one long side and one end?

5. If he buys another board 6 feet long, can he cut it to make the other side and end? Will there be any left over?

6. At $4\frac{1}{2}$ cents a foot, what will the 6-foot board cost?

7. Allen needs $\frac{1}{2}$ pint of blue paint for the box. The $\frac{1}{2}$-pint can of paint costs 10 cents. How much is that a quart?

*8. Find out how lumber and the wood in trees is measured. What is a "board foot"?

*9. How much is a "cord" of wood? What kind of wood is sold by the cord?

*10. Look up the prices of different kinds of wood and lumber. What is one of the most expensive kinds of wood? What is it used for?

PLACING DECIMAL POINTS IN QUOTIENTS

1. Copy these examples and show by using marks ($\wedge$) that the decimal points in the quotients are placed correctly. (Do not mark your book.)

$$\begin{array}{lllll} .11 & 2.5 & .09 & 200. & 1750. \\ 3.2\overline{).352} & .25\overline{).625} & 5\overline{).45} & .32\overline{)64.00} & .056\overline{)98.000} \end{array}$$

The figures in the quotients below are correct. Where should the decimal points be placed?

$$\begin{array}{llll} \text{2. } 138 & \text{6. } 98 & \text{10. } 36 & \text{14. } 210 \\ .7\overline{).966} & .9\overline{)8.82} & 8.4\overline{)3.024} & .045\overline{)9.45} \\ \text{3. } 25 & \text{7. } 81 & \text{11. } 92 & \text{15. } 48 \\ .25\overline{).625} & .08\overline{)6.48} & 4\overline{)3.68} & 32\overline{)153.6} \\ \text{4. } 11 & \text{8. } 15 & \text{12. } 23 & \text{16. } 32 \\ 1.5\overline{)165} & .11\overline{)16.5} & 2.1\overline{)483} & .021\overline{).672} \\ \text{5. } 121 & \text{9. } 12 & \text{13. } 2 & \text{17. } 32 \\ 8\overline{)9.68} & 1.2\overline{)144} & 1.1\overline{)22} & .048\overline{)1.536} \end{array}$$

PRACTICE IN DIVISION

Watch the decimal points in these examples:

	a	*b*	*c*	*d*
1.	$1.1\overline{)4.62}$	$3.1\overline{)34.1}$	$2.3\overline{).483}$	$3.6\overline{)79.2}$
2.	$.41\overline{)13.12}$	$.23\overline{)9.89}$	$5.3\overline{)2.226}$	$.55\overline{).605}$
3.	$.25\overline{)87.5}$	$.048\overline{)15.36}$	$.22\overline{)3.08}$	$.063\overline{)428.4}$

Express the answers to the nearest hundredth:

4.	$7.8\overline{)2.801}$	$3.5\overline{)428.3}$	$1.8\overline{)13.52}$	$.06\overline{)1.13}$
5.	$6.5\overline{)1.973}$	$4.8\overline{)120}$	$.23\overline{)5.53}$	$3.6\overline{)17.1}$
6.	$7.2\overline{)70.2}$	$.15\overline{)64.56}$	$8.3\overline{)2.527}$	$96\overline{)77.568}$

INSERTING ZEROS IN THE QUOTIENT

1. Mr. Brown used 1.25 gallons of gasoline to go 25 miles in his automobile. How much did he use to go 1 mile?

THINK: 1.25 gal. ÷ 25 = ?

$$\begin{array}{r} .05 \\ 25\overline{)1.25} \\ \underline{1\,25} \end{array}$$

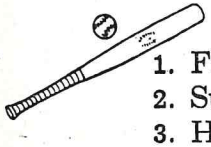
The quotient figure 5 will go in the second decimal place. To fill the empty place, write in a 0 between the decimal point and the 5. What place does the 0 hold?

2. Copy the examples below. Put the decimal points in the quotients. Write in the zeros that may be needed.

a. $\begin{array}{r} 6 \\ 32\overline{)1.92} \end{array}$ *b.* $\begin{array}{r} 7 \\ 7.5\overline{).525} \end{array}$ *c.* $\begin{array}{r} 4 \\ .6\overline{).024} \end{array}$ *d.* $\begin{array}{r} 32 \\ 48\overline{)1.536} \end{array}$

Divide. Write in zeros when needed.

	a	*b*	*c*	*d*
3.	$.5\overline{).025}$	$4\overline{).172}$	$.8\overline{).024}$	$9\overline{).045}$
4.	$1.1\overline{).1022}$	$1.2\overline{).108}$	$2.5\overline{).175}$	$.9\overline{).018}$
5.	$21\overline{).861}$	$4.5\overline{)9.585}$	$5.4\overline{).2754}$	$.59\overline{)50.386}$



LET'S PRACTICE

1. Find the sum of $6\frac{1}{2} + 4\frac{1}{4} + 2\frac{7}{8}$.
2. Subtract $4\frac{7}{8}$ from $9\frac{1}{2}$.
3. How much is $6\frac{1}{2} \times 24$?
4. Multiply $7\frac{1}{2}$ by $3\frac{1}{5}$. Check by division.
5. Divide $12\frac{1}{2}$ by 5. Check by multiplication.
6. How many times is $\frac{3}{4}$ contained in 18?
7. How much is 7.9 + 8.6 + 9.8?
8. Subtract 4.85 from 9.60.
9. How much is 29 × 47.5? Check by division.
10. How much is 4.8 × 3.5? Check by division.
11. Reduce to decimals: $\frac{9}{25}$; $\frac{4}{5}$; $\frac{3}{20}$; $\frac{5}{8}$.
12. Express as decimals to the nearest hundredth: $\frac{2}{3}$; $\frac{5}{6}$.

PRACTICE IN DIVISION OF DECIMALS

How many of the examples in each set below can you work correctly? Be sure to place the decimal points in the quotients correctly. Carry the work to not more than three places. Round off the answers to the nearest hundredth.

Set I

	a	*b*	*c*	*d*
1.	$2\overline{)8.6}$	$3\overline{)6.9}$	$4\overline{)8.4}$	$2\overline{)2.4}$
2.	$3\overline{)7.44}$	$7\overline{)9.17}$	$5\overline{)6.35}$	$6\overline{)9.42}$
3.	$9\overline{)10.728}$	$8\overline{)1.896}$	$6\overline{)13.776}$	$5\overline{)28.365}$
4.	$2\overline{).8}$	$7\overline{).84}$	$4\overline{).76}$	$5\overline{)1.75}$
5.	$6\overline{).978}$	$5\overline{).635}$	$9\overline{).927}$	$4\overline{).828}$
6.	$4\overline{).12}$	$9\overline{).36}$	$6\overline{).048}$	$7\overline{).084}$
7.	$24\overline{)3.6}$	$55\overline{)2.2}$	$4\overline{)2}$	$16\overline{)12}$
8.	$25\overline{)64}$	$16\overline{)34}$	$18\overline{)27}$	$24\overline{)30}$

Set II

1.	$.3\overline{)6.3}$	$.4\overline{)4.8}$	$1.2\overline{)8.4}$	$2.3\overline{)9.2}$
2.	$.3\overline{)18.27}$	$.7\overline{)35.98}$	$2.5\overline{)34.75}$	$.9\overline{)64.35}$
3.	$.4\overline{)1.2}$	$.8\overline{)6.4}$	$4.2\overline{)2.1}$	$.56\overline{)1.4}$
4.	$.12\overline{)1.44}$	$1.7\overline{)8.687}$	$.16\overline{)17.92}$	$.25\overline{)72.775}$
5.	$.16\overline{)1.2}$	$.28\overline{).7}$	$.08\overline{)1}$	$.36\overline{)45}$
6.	$.024\overline{)1.825}$	$.64\overline{)2.4}$	$.018\overline{)3.996}$	$9.6\overline{)12.672}$
7.	$.17\overline{)8.5}$	$.019\overline{)49.97}$	$.32\overline{)928}$	$.061\overline{)57.889}$
8.	$9.7\overline{)12.1}$	$.85\overline{)1.81}$	$.067\overline{)3.29}$	$77\overline{)14.1}$

WE USE DECIMALS IN MANY PROBLEMS

1. Sir Malcolm Campbell averaged 4.65 miles a minute in an automobile driving speed test at Daytona Beach. At that rate how far would he go in 10 minutes? in an hour?

2. A bottle of tomato juice weighed 8.6 ounces. A bottle of pineapple juice weighed 8.35 ounces. Which was heavier? How much was the difference in weight?

3. Ice weighs about .9 times as much as water. How many pounds of ice could be made from 50 pounds of water?

4. Mr. Pratt wondered how economically his automobile used gasoline. So he filled the tank, and after he had driven 200 miles he found that it took 12.5 gallons to refill the tank. How many miles to a gallon of gasoline did Mr. Pratt get?

5. John belongs to a 4-H Club. He has one acre of land on which he raises corn. Last year he raised 96.38 bushels. This year he raised 102.7 bushels. What was the average yield of corn for the two years?

6. In Philadelphia one year it rained 4.9 inches in July and 6.3 inches in August. How much greater was the rainfall in August than in July? What was the average rainfall for the two months?

*7. If the total rainfall for the year was 28.6 inches, which was nearer the monthly average, July or August?

*8. What is the total yearly rainfall where you live? What is the average monthly rainfall?

DIAGNOSTIC TEST IN DIVISION OF DECIMALS

Use this test to find out how well you can divide by decimals. If you miss more than one example in a row on the test, turn for help to the pages given at the right. Then correct your work.

	a	*b*	*c*	*d*	
1.	$.5\overline{)3.5}$	$.4\overline{)8.4}$	$1.6\overline{)9.6}$	$1.8\overline{).72}$	(287)
2.	$.25\overline{)3.75}$	$.12\overline{)1.44}$	$.32\overline{)7.04}$	$.84\overline{)20.16}$	(288)
3.	$.11\overline{)12.1}$	$.15\overline{)37.5}$	$.08\overline{)40.8}$	$.07\overline{)46.9}$	(288)
4.	$.4\overline{)2}$	$1.4\overline{)84}$	$.32\overline{)16}$	$.6\overline{)48}$	(289)
5.	$.012\overline{).192}$	$.025\overline{)1.75}$	$.048\overline{)1.584}$	$.072\overline{)1.44}$	(290)
6.	$.5\overline{).25}$	$.4\overline{).032}$	$2.5\overline{).1275}$	$8.2\overline{).246}$	(294)

Express the answers to the examples below to the nearest hundredth.

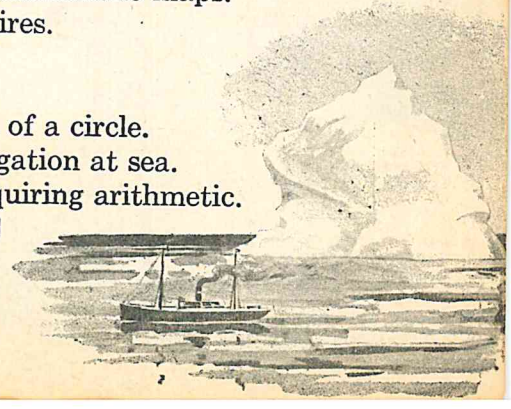
7.	$.37\overline{)4.96}$	$1.8\overline{)6.75}$	$.054\overline{)2.583}$	$97\overline{)38.26}$	(294)

Repeat also the diagnostic test in division on page 283.

*INTERESTING FACTS TO FIND OUT

If you do not need to practice on division of decimals, you may select one of the following topics and prepare a report on it.

1. The difference between wholesale and retail stores.
2. How to locate places on automobile maps.
3. The sizes of automobile tires.
4. What a water meter is.
5. Why ice floats.
6. How to measure the area of a circle.
7. Instruments used in navigation at sea.
8. Some Boy Scout tests requiring arithmetic.



SALT FOR OUR TABLE

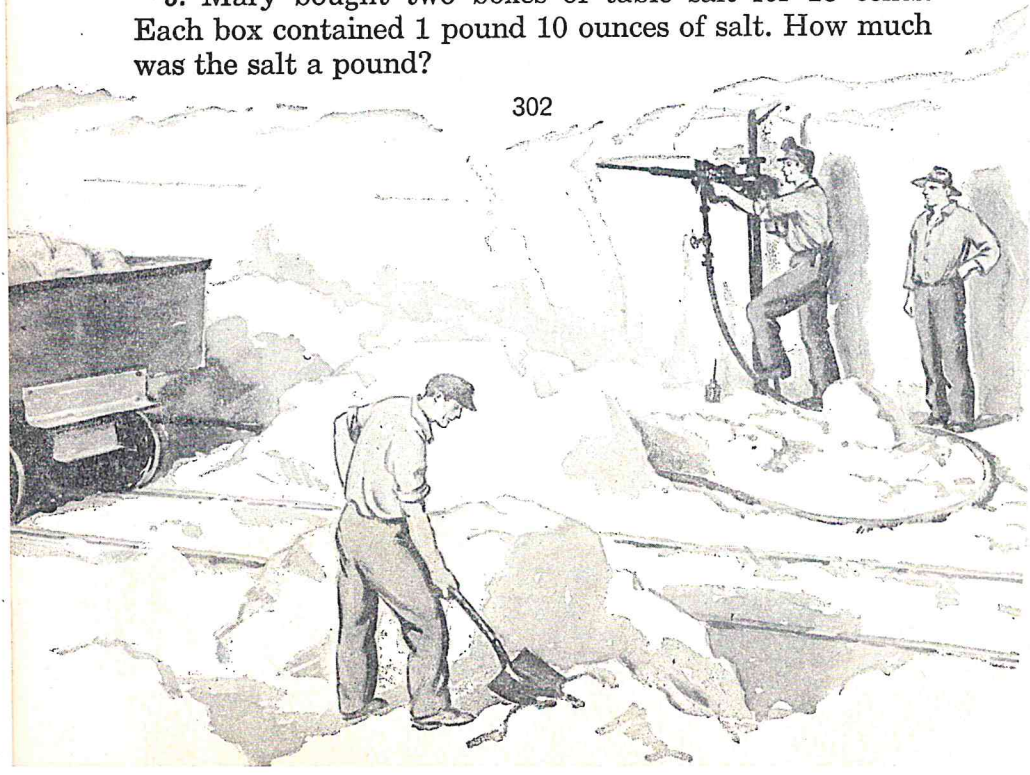
1. In a recent year the United States produced about $7\frac{1}{2}$ million tons of salt. How many pounds was this?

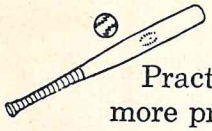
2. About $\frac{1}{3}$ of the salt was produced in rock salt mines. How many tons was this?

3. Water in the ocean contains much salt. When the water is evaporated, the salt remains. In a pound of water in the polar regions there is about .029 pound of salt. Near the equator a pound of sea water contains as much as .033 pound of salt. Find the difference in these amounts. Can you give any reason for the difference?

4. Much of the salt of the world comes from evaporating sea water. A gallon of sea water contains about 0.25 pound of salt. How many gallons of sea water must be evaporated to produce a pound of salt? a ton of salt?

*5. Mary bought two boxes of table salt for 13 cents. Each box contained 1 pound 10 ounces of salt. How much was the salt a pound?





LET'S PRACTICE

Practice one of these sets of examples a day. If you need more practice, work the same set on several days. Keep a record of your scores to see how your work improves.

Set I

1. $985\frac{1}{2}$, $968\frac{1}{4}$, $892\frac{1}{8}$, $595\frac{3}{4}$, $652\frac{3}{8}$, $167\frac{1}{2}$

2. $985.4 - 276.8$

3. $865\frac{1}{4} - 296\frac{1}{2}$

4. 9.76×2.4

5. $25\frac{1}{2} \times 9$

6. $9\frac{1}{3} \div 7 =$

7. $9\overline{)87.57}$

8. 3 hr. 27 min. + 6 hr. 40 min.

9. $\frac{3}{4} \times \frac{5}{6} =$

10. $27\overline{)1107}$

Set II

1. 598.9, 74.9, 9984.2, 7.9, 327.7, 265.8

2. $462\frac{3}{4} - 243\frac{5}{6}$

3. 89.3×5.07

4. $.6\overline{)3.75}$

5. $5\frac{1}{3} \times 3\frac{1}{4} =$

6. $6\frac{1}{4} \div 1\frac{2}{3} =$

7. 9 gal. 2 qt. − 4 gal. 3 qt.

8. $.12\overline{)14.4}$

9. $\frac{3}{4}$ of $1\frac{1}{6} =$

10. $19\overline{)15086}$

USING THE VOCABULARY OF ARITHMETIC

Write sentences containing these words. Be ready to read the sentences to the class.

equator	majority	triple	sum
quotient	growth	income	round numbers
approximate	batting average	board foot	to the nearest inch
incomplete	bank	gain	deposit

HOW WELL DO YOU REMEMBER?

Read each statement. Decide whether it is **true** or **false**. Write "True" or "False" as your answer. Be ready to show why your answer is correct.

1. We invert the divisor when we divide by a fraction.
2. The fraction $\frac{9}{10}$ is reduced to lowest terms.
3. $9\frac{3}{2} = 10\frac{1}{2}$.
4. Dividing both numerator and denominator by the same number does not change the value of a fraction.
5. The distance around a field is called its area.
6. To change 6 yards to inches, multiply 6 by 12.
7. All rectangles are squares.
8. All squares are rectangles.
9. There will be 3 decimal places in the product of 4.7 $\times$ 2.65.
10. The area of a $3' \times 5'$ rectangle is 15 square yards.
11. A bar graph and a picture graph are the same.
12. The distance 18.375 ft. to the nearest tenth is 18.4 ft.
13. Twelve ounces equal $\frac{1}{2}$ pound.
14. The common denominator of $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$ is 12.
15. In division the answer is sometimes less than 1.
16. If $\frac{2}{3}$ of a number is 12, the number is 18.
17. 25×375 is nearer 9000 than 6000.
18. The quotient of $28.675 \div .75$ is about 35.
19. A two-cent stamp has an area of about 1 square inch.
20. The average of 21, 36, and 36 is 31.
21. A discount is more than the regular price.
22. People are always paid by the hour for the work they do.
23. The fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{6}$ are arranged in the order of their value.

MEASURING GROWTH IN PROBLEM SOLVING

This is the last problem scale for this year. Try to get a rating of **Excellent.**

1. Harry bought a $5 football for $3.75. How much was the reduction?
2. If $\frac{1}{2}$ pound of sausage costs 12 cents, how much does one pound cost?
3. An 8-ounce glass of jam cost 12 cents. How much was that an ounce?
4. If bananas cost 3 pounds for 19 cents, how much do 6 pounds of bananas cost?
5. A rug is $10\frac{1}{2}$ feet long and 12 feet wide. What is the area of the rug?
6. The label on a can of berries showed that the can weighed 1 pound 8 ounces. How much do 5 cans weigh?
7. Jane has $4\frac{1}{2}$ yards of cloth with which to make 3 curtains. How many yards of cloth can she use for each of the three curtains if they should all be of the same length?
8. Jack found that it costs $2\frac{1}{2}$ cents an hour to use the electric toaster. If the toaster is used for $\frac{1}{4}$ hour each day, how much does it cost to use the toaster for one week?
9. An airplane flew 337.5 miles in 1.5 hours. How many miles an hour did the airplane fly on the average?
10. It takes about 1.25 bushels of wheat for seed for an acre of land. At $.80 a bushel how much would the seed cost to plant a 30-acre field?

What Your Score Means

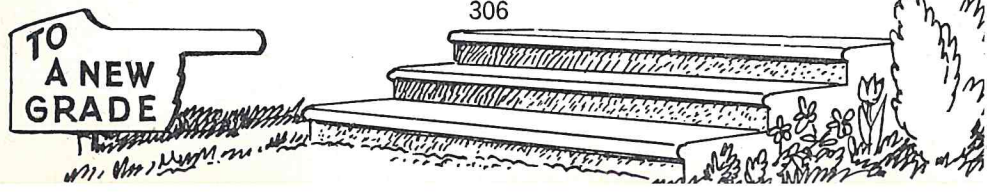
Unsatisfactory	Fair	Good	Excellent
0 1 2 3 4	5 6	7 8	9 10

UP THE STEPS TO THE NEXT GRADE

This test will show you how well you have learned the arithmetic of this grade. Be sure to copy the numbers correctly and to leave enough space for your work.

1. Subtract 3 ft. 8 in. from 6 ft. 3 in. (156)
2. How much is 5 times 2 hr. 15 min.? (264)
3. How much is 400 $\times$ \$12.75? (174)
4. Divide 4086 by 85. Check by multiplication. (77)
5. Add: $8\frac{1}{3} + 6\frac{1}{2} + 7\frac{5}{6} + 6\frac{2}{3} = ?$ (118)
6. Subtract $6\frac{1}{2}$ from $9\frac{1}{4}$. (144)
7. Multiply: *a*. $8 \times 12\frac{3}{4} = ?$ *b*. $5\frac{1}{3} \times 2\frac{1}{4} = ?$ (185)
8. Divide: *a*. $6 \div \frac{3}{4} = ?$ *b*. $7\frac{1}{2} \div 1\frac{1}{5} = ?$ (211)
9. Add: .875 + .125 + .450 + .695 = ? (42)
10. Subtract 6.25 from 19.75. (49)
11. Express as fractions: .25; .5; .125. (38)
12. Reduce to two-place decimals: $\frac{3}{4}$; $\frac{7}{8}$; $\frac{2}{3}$. (276)
13. How much is .48 $\times$ 16.7? (253)
14. Multiply 27.4 by 18.6. (253)
15. Divide 37.4 by 48. Check by multiplication. (274)
16. Give to the nearest tenth: 8.736; 15.137; 20.35. (280)
17. Divide 58.42 by 3.6, correct to the nearest hundredth. (287)
18. How many times is .075 contained in .675? (290)
19. How much is 37.5 divided by .15? (288)
20. Divide 27 by 1.2. Check your answer by multiplication. (289)

After your paper has been marked, correct your errors at once. If necessary, turn for help to the pages given at the right. Be sure that you know how to work correctly every example in the test.



TABLES OF MEASURES

For Reference

Counting

12 things = 1 dozen
12 dozen = 1 gross
20 things = 1 score

Capacity

Liquid Measure

4 gills = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
31½ gallons = 1 barrel
231 cubic inches = 1 gallon

Dry Measure

2 pints = 1 quart
8 quarts = 1 peck
4 pecks = 1 bushel
2,150.42 cubic inches = 1 bushel

Weight

Avoirdupois Weight

16 ounces = 1 pound
100 pounds = 1 hundredweight (cwt.)
2,000 pounds or 20 hundredweight = 1 ton
2,240 pounds = 1 long ton

196 pounds = 1 barrel of flour
62.5 pounds = 1 cubic foot of water
*60 pounds = 1 bushel of wheat or potatoes
*56 pounds = 1 bushel of corn or rye

Troy Weight

For jewels and precious metals
24 grains = 1 pennyweight (pwt.)
20 pennyweights = 1 ounce
12 ounces = 1 pound
5,760 grains = 1 pound (Troy)
7,000 grains = 1 pound (Avoirdupois)
4 grains = 1 carat

Length

12 inches = 1 foot
3 feet = 1 yard
16½ feet or 5½ yards = 1 rod
5,280 feet / 1,760 yards / 320 rods = 1 mile

Surface or Square Measure

144 square inches = 1 square foot
9 square feet = 1 square yard
30¼ square yards = 1 square rod
160 square rods or 43,560 square feet = 1 acre
640 acres = 1 square mile, or 1 section
36 sections = 1 township

Time Measure

60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day

* In most states.

TABLE OF MEASURES—(Continued)

7 days = 1 week
365 days = 1 year
366 days = 1 leap year

Metric System (Equivalents)

10 millimeters = 1 centimeter
100 centimeters = 1 meter
1,000 meters = 1 kilometer

1 inch = 2.54 centimeters
1 foot = 30.48 centimeters
1 yard = 0.9144 meters
1 mile = 1.6093 kilometers

Pages 309-312 (Index)
not required.